How...

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BALANCED VALVE REGULATORS

Save money on service!

VALVE CHAMBERS CAN BE REPLACED WHILE REGULATORS REMAIN IN THE LINE

WITH an Emco there is no need to bring the entire regulator into the shop when the valve chamber (inlet bowl assembly) requires servicing. This unit is easily removed through a hand hole plate in the body *while the regulator remains in the line.* A new or rebuilt replacement valve chamber having either hard or soft seats readily bolts in its place. At the same time, if desired, the capacity of the regulator can be changed by simply substituting a different size valve chamber in the same regulator body.

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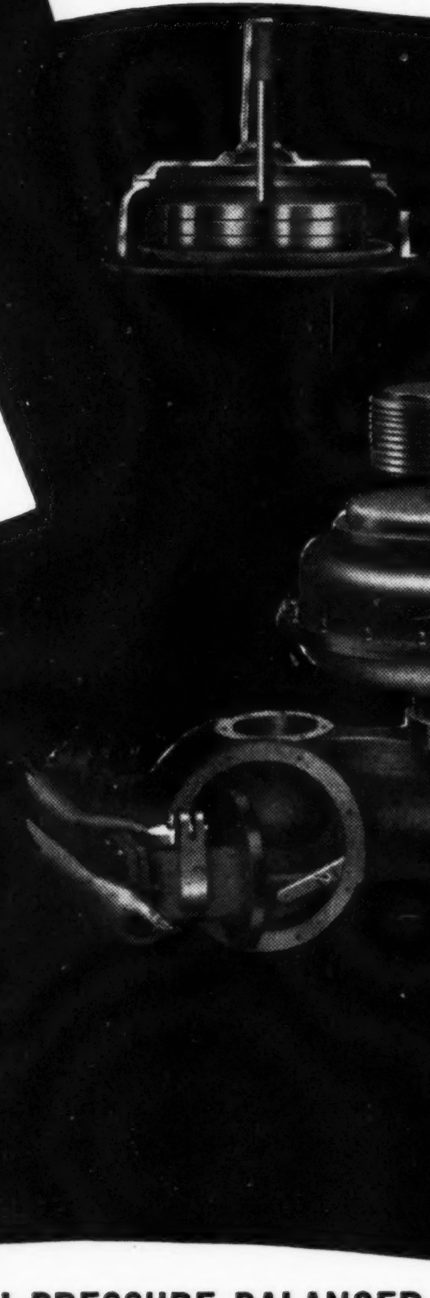
Atlanta Boston Chicago Houston Kansas City
Los Angeles New York Pittsburgh San Francisco
Seattle Tulsa

EMCO LOW PRESSURE BALANCED VALVE REGULATOR



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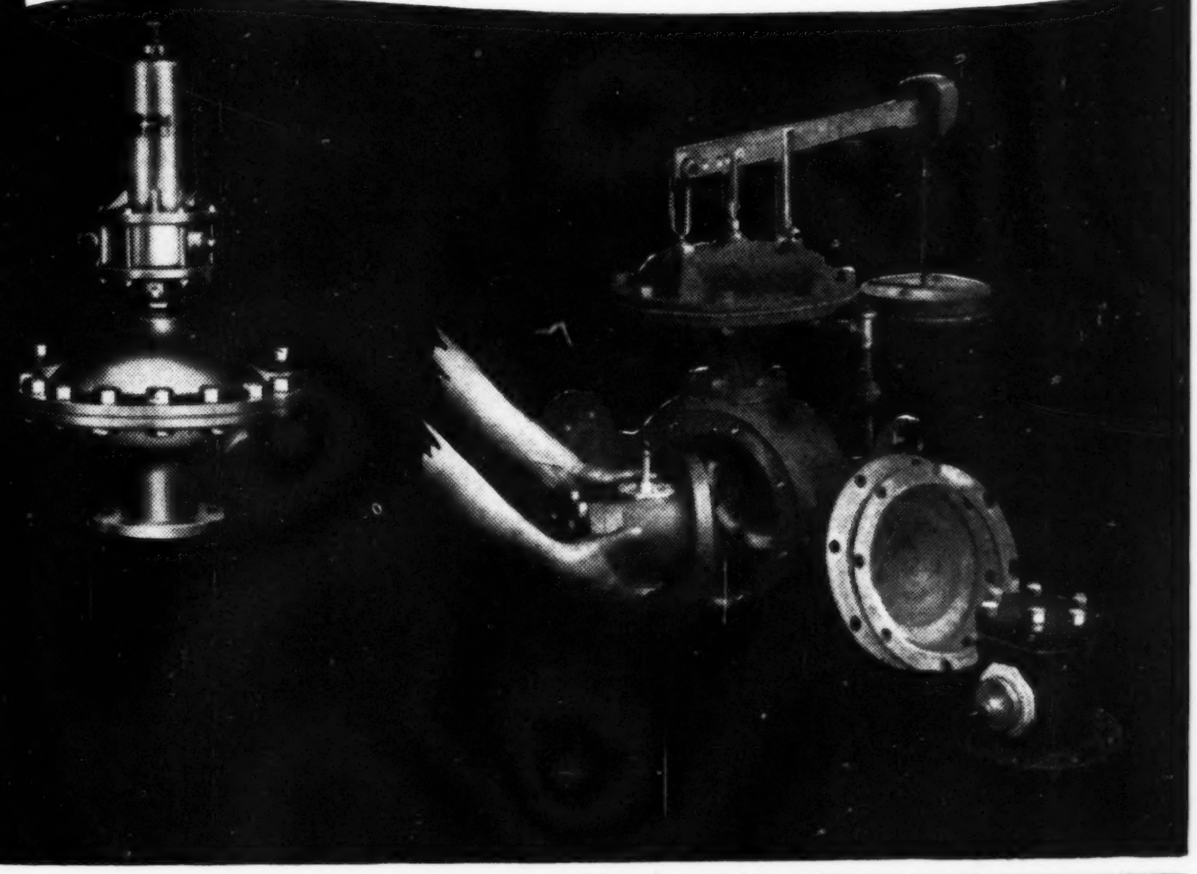
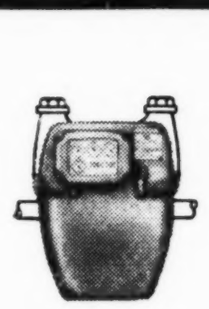


EMCO GAS METERS AND REGULATORS FOR EVERY REQUIREMENT



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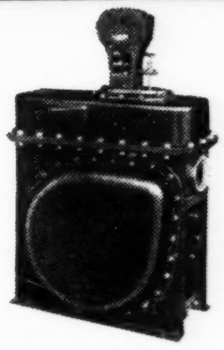
Tin Meters

Cast Iron Meters



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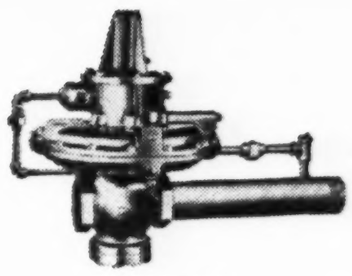
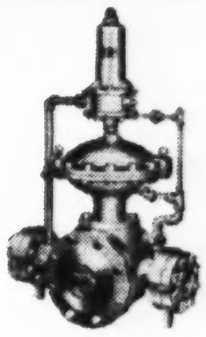
E,ector Service Regulators



"1001" Regulators



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GAS

REG. U. S. PATENT OFFICE

Twenty-Fifth Year of Publication

April, 1949 CCA NBP ASSOCIATION **Vol. 25—No. 4**

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Highlights

1948 WAS FPC'S MOST ACTIVE YEAR. In its annual report, the commission (speaking of gas transmission lines) pointed out that, despite a decrease from 132 to 98 in the number of certificates issued, projects on the whole were more extensive and costly than ever before. Authorized facilities included 8500 miles of pipelines and half a million compressor horsepower costing over half a billion.

ALBERTA HAS 4.26 TRILLION CU FT OF GAS RESERVES. This figure was presented by the Dinning royal commission recently after a four-month study. The research was undertaken to determine whether the province could spare gas for the proposed line to Seattle, Vancouver, and Portland, Ore. Annual withdrawals for local use are about 32 billion now. The commission refused to make any recommendations.

THE SQUEEZE EASES. Evidence poured in last month that the tight gas supply situation is loosening up a bit around the edges. Curtailment of space heating installations has been partially lifted or otherwise modified in Pittsburgh, Cincinnati, several New York cities, and a few other localities.

MANHATTAN STRIKE THREAT RESOLVED IN NO-STRIKE CONTRACT. Consolidated Edison of New York, facing a system-wide strike, came up instead with a new contract with Utility Workers Union of America (CIO). No strikes or lockouts for two years, a union shop, and wage boosts are guaranteed. A unique provision requires disclosure by any employee of membership in a subversive organization.

BUSY MONTH. Gasmen will spend a lot of time going from one convention to another this month. The AGA Distribution, Motor Vehicle, and Corrosion Conference in Cincinnati will be immediately followed by GAMA's convention in Colorado Springs, AGA Sales Conference on Commercial and Industrial Gas, at least three regional association meetings, and half a dozen others of top interest.

ATOMIC ENERGY POWER PILOT PLANT BY 1954 FORECAST. A small plant of at least some hundreds of horsepower within five years; one or more plants of 100,000 hp or more in 20 years—such was the picture painted last month by Dr. T. R. Hogness, University of Chicago radiobiology and biophysics director. Eventually America might be a smoke-free nation powered by 100 or more electrical generating plants, atom-powered, capable of producing a million or more kilowatts, he thought.

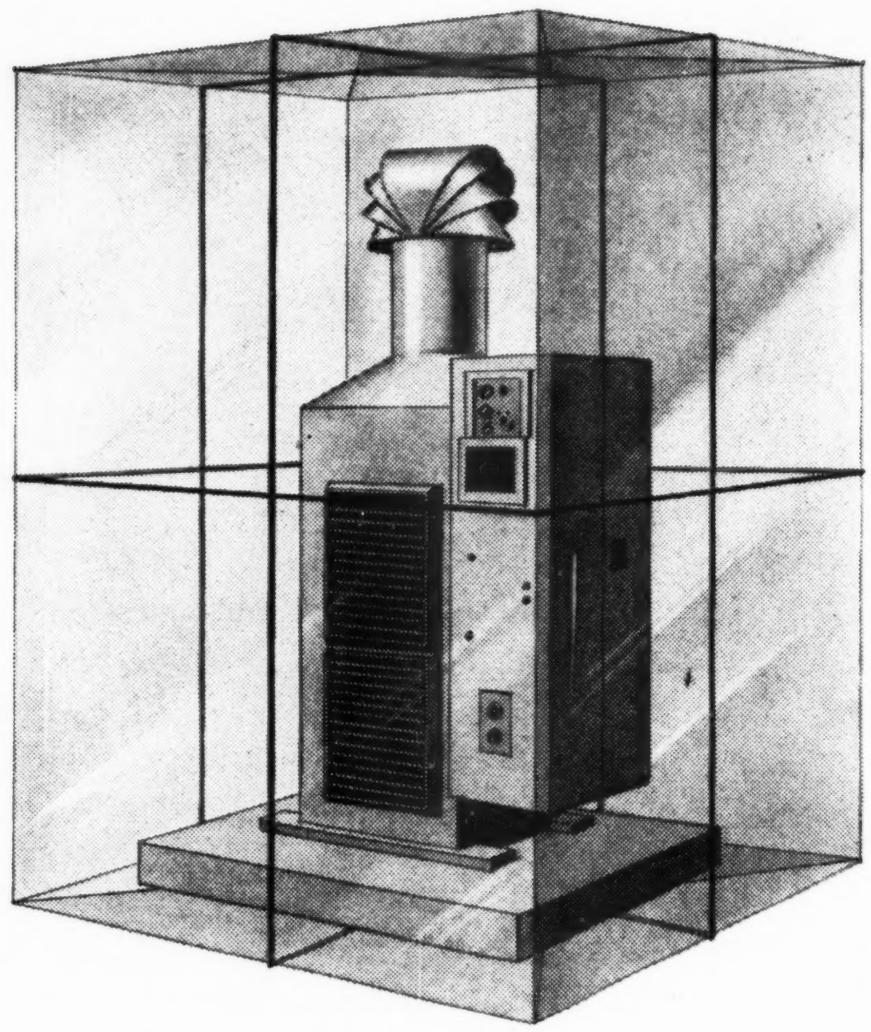
SALES OF NATURAL GAS CONTINUE UPWARD. January showed an increase of 12.6% over the corresponding 1948 period, overshadowing losses in mixed and manufactured sales of 21.8% and 10.5% respectively. Changeover of several large utilities to natural accounted to a large extent for the downward trend in the latter two. Topsy-turvy weather which brought record-breaking loads to natural gas areas may have been a factor. Net gain, overall, was 8.9%.

MOVES AFOOT IN CONGRESS TO AMEND NATURAL GAS ACT. Once more, the legislative bodies are beginning to give thought to a clarification of the act. A subcommittee of the House Interstate Commerce Committee was due to swing into hearings late last month on two separate bills, one introduced by Chairman Oren Harris (Dem.-Ark.), the other by John E. Lyle (Dem.-Tex.). Both bills would overrule the Supreme Court decision which broadened FPC jurisdiction over gathering operations.

DELHI OIL CO. IS NOT A NATURAL GAS COMPANY. The FPC has finally cleared up the status of the San Juan Basin (New Mexico and Colorado) lease owner, which proposes to sell gas to El Paso Natural for transport to Pacific Gas & Electric Co. in San Francisco. Delhi's application for exemption from FPC jurisdiction had several times previously been denied. FPC'c latest action may help clear the way for ultimate approval of the San Juan line, severed late in February from PG&E-El Paso application proceedings. Delhi has a 25-year contract to deliver 110 MMcf per day to El Paso.

GENERAL ELECTRIC SLICES PRICES. Not overwhelmingly impressive, yet newsworthy, was GE's announcement that it was lowering range, refrigerator, and home freezer prices from 4% to 10%. In cash terms, prices on five range models were lopped from $10 to $20, on an 8-cu ft refrigerator $14.

The ANSWER to your
FUEL SHORTAGE PROBLEM
is in
THIS PACKAGE ☛



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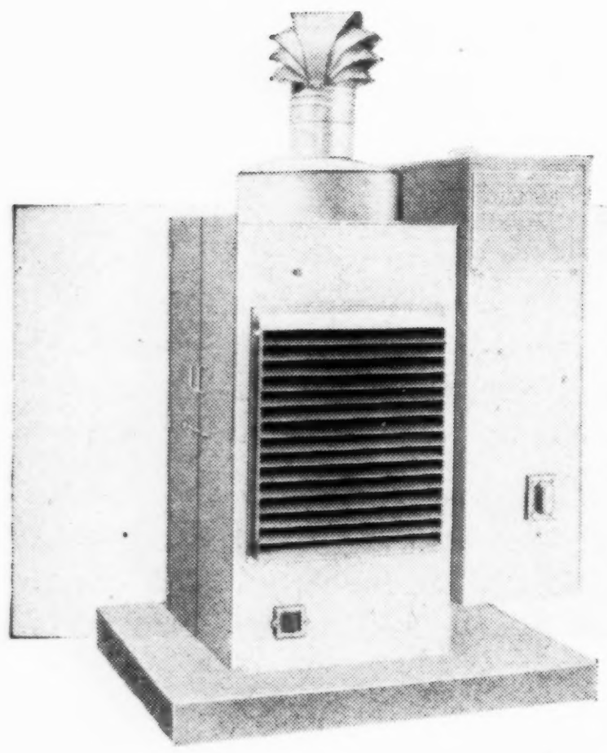
For complete information regarding GASAIR, write for Bulletin 393-AC.



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THERMALLY THINKING

By EDWARD TITUS

behind the scenes at CR

SOME PEOPLE BELIEVE that Consumers' Research Inc. of Washington, N. J. is on the electric side of the fence. We paid them a visit the other day to try to find out.

They say no, they're not on either side of the fence. They also say they correct earlier statements sometimes, and don't mind admitting it if they later believe they've been wrong.

This spring they plan to do a couple of things which may have a good effect. For one thing, Frederick J. Schlink, their Number One man, is going to pay his first visit to the American Gas Assn. laboratory in Cleveland. He's interested in this lab because he was with the Bureau of Standards in Washington when it was set up, and the gas people got certain advice from the bureau about how to do it.

For another thing, Consumers' Research (known for short as CR) this spring expects to make its first test in 10 years of the leading gas refrigerator—that is, have the test made for them.

The reports CR has been issuing to its subscribers have had to do with the gas refrigerator of 1939.

How would the electric people like it if their ranges of today were judged by those of 10 years ago?

Information has come to us that salesmen for electric appliances have been exhibiting certain reports of Consumers' Research as purporting to show advantages of electric appliances in comparison with gas ones. We have been informed by Consumers' Research that this, from their point-of-view, is improper. Their reports are issued as semi-confidential communications between themselves and their subscribers, and they are not supposed to be used by salesmen. So if anyone catches an electric salesman showing Consumers' Research material around, the thing to do is to write about it to Mr. Frederick J. Schlink, Consumers' Research Inc., Washington, N. J. Or it might be a good idea to communicate about any improper, misleading or out-of-context use of this or other material by electric salesmen, with the Edison Electric Institute, 420 Lexington Ave., New York City, the American Gas Assn. at the same address, or *GAS*, at our New York or Los Angeles offices. We're indebted to F. D. Bradley, purchasing agent of Southern Union Gas Co., Dallas, for calling to our attention these Consumers' Research reports, and doubtless Mr. Bradley also would be interested in any further information from the rest of the industry.

Answering our query about whether they had any tendency to favor electric rather than gas appliances, Mr. Schlink denied this was so. They often attack electric appliances and various electric devices, and plenty of manufacturers of electric equipment are angry with them from time to time. So if an electric salesman is showing around some little out-of-context statement from CR and failing to tell some of the things of an unfavorable nature they've said about certain electric equipment, he's not giving the full picture.

Since Mr. Schlink has supplied the writer with material and given us permission to make a few minor quotes and references, we'll review briefly some of their statements that certain electric people haven't liked.

In 1947, Consumers' Research in a two-column report on electrical hazards stated that faulty wiring and equipment or misuse of electricity are responsible for between 5% and 10% of fires in this country. It pointed out that these figures may be low, rather than high, because when a building is completely destroyed, the cause is reported as unknown unless someone really knows how the fire started.

In addition to the property hazard, there is a considerable hazard to human life, Consumers' Research pointed out, since about 1300 people are killed accidentally by electricity every year, and a good many of these deaths are due to accidental contact with low voltage (110 volts) circuits in the home.

In May, 1947, Consumers' Research reviewed a gadget type of electric water heater which is submerged in water, and then plugged in. In addition to asserting hazards of this heater, CR declared it cost about three times as much to heat water with this type of electric heater, as with gas.

In a discussion of electric ranges by Consumers' Research that, we are told, has been used by electric salesmen, its value to the salesmen is there only by virtue of his singling out individual statements. If the whole story of what the organization said about electricity vs. gas were told, it would be seen that CR said the electric product is more expensive to buy, more expensive to install, and more expensive to operate, and that there are certain operating results, some favoring one product, some the other.

If an electric salesman were really eager to give the full picture he could turn to one of the organization's bulletins where hazards in use of household appliances are discussed, which starts with the electrical hazards and gives about equal space to electric, gasoline and gas hazards.

The whole thing leads off with a statement that the "so-called low voltages" used in house wiring, although often used carelessly by the consumer,

are "dangerous and warrant extreme caution."

Four column-inches are devoted to these electrical hazards and how to meet them, and 3 in. each to the hazards to be avoided in using gasoline and gas. In the gas section, CR urges its subscribers to permit no gas leaks, and that appliances should be connected with gas mains only with rigid (permanent) piping, and that oven vents and especially vents of water heaters and heating stoves should be connected to a flue or vent pipe. Hazards of improper use of gas appliances are pointed out, and it is stated that "well-managed gas companies will arrange to inspect and adjust burners without extra charge." The reader who wants to pursue the matter further is referred to "Safe at Home," which can be had for a dime from the National Safety Council in Chicago.

As further evidence of how they operate, Mr. Schlink points out they frequently have called attention to the hazards of certain electric fuses, certain radios, waffle irons, an electric beater, and certain electric toasters.

who's who

Now what is Consumers' Research Inc.?

Essentially it might be described as a service for which subscribers pay. Listed first among the technical experts and editors is Mr. Schlink, a mechanical engineer and physicist. Also associated is D. C. Aten, another physicist. There are about 60 people at the organization's headquarters in Washington, N. J., including half a dozen engineers and technicians and four or five laboratory assistants. Mr. Schlink states that on occasion they also use special consultants of whom there are 200 to 300 they occasionally call on; furthermore that they turn over work to about a dozen of the largest technical laboratories.

Out of fairness it should be stated that Consumers' Research has no connection with and in fact is a rather sharp competitor of another organization with a similar name that has its headquarters on Union Square, New York. Many of those who have been connected with the Union Square organization have had left-wing affiliations. Consumers' Research, on the other hand, insist that they have no axe to grind for labor, the New Deal, or anyone.

Another observation is that the consumer, or the electric salesman or the gas appliance salesman who tried to interpret some Consumers' Research finding as official, or almost infallible, would be making a mistake. They're not hooked up with the government, or apparently with any such semi-public organization as a large university. They farm out research jobs to various laboratories and individuals, their own staff being admittedly small from the engineering point of view.

Actually, the personal opinion of the small technical staff in Washington, N. J., has a lot to do with it, according to our hunch.

We hope their head man *does* pay that first visit to the AGA laboratories!

dealer has his say

WEST COAST DEALER ATTITUDES, both good and bad, were recorded recently in a series of interviews made by a representative of Jenkins Publications, Inc., publishers of *GAS*. Purpose of this pilot study was to ascertain the general thinking of appliance dealers—particularly in regard to the sudden decline in appliance sales; also to find out their attitude toward a number of vital questions involving the utility companies and appliance manufacturers.

The results in some instances were quite revealing; in others, they merely confirmed what was already common knowledge in the industry.

All dealers interviewed complained about the drop in the volume of sales —in some cases, as much as 20% from that of the same period the previous year. However, not all expressed alarm. Some, particularly experienced dealers, even welcomed this apparent change from a sellers' to a buyers' market.

manufacturer on the carpet

However, all are sourly angry about price cutting. They blame this principally on appliance manufacturers for flooding the market, and for handing out franchises to anybody with space to display merchandise, without any regard to the individual's financial standing or his knowledge of the appliance field. Then, too, they are piqued over alleged inequalities and discriminations which they experienced during the war and the period immediately following, by manufacturers whose only thought was production and more production.

Specifically, each dealer aired his gripe—all aimed at the appliance manufacturer. Some maintain that from 10% to 80% of the appliances shipped to them required repair. They resented the red tape and suspicion with which many manufacturers greeted their claims—particularly with regard to their difficulties in getting spare parts and the annoyance and cost of correcting faults due to poor factory inspection and crating. And many are still smarting over this treatment.

how utilities rate

Their attitude toward the utilities, while less severe, indicated that all was not rosy. First each dealer is an individual business man who wants a measure of individual attention. They resent what they termed regimentation and paternalism in the activities of the average utility dealer contact department, or the complete absence of interest when no such department exists. Their resentment for the most part was aimed at dealer cooperation plans that tend to discriminate them from other dealers who are in the "fold."

Despite this criticism, many of the dealers complimented the service arrangement of many utilities, particularly insofar as it lends a promotional assistance to their sales effort. However, they will recognize this assistance only if it is directly measurable in profitable sales.

Most of the dealers expressed a preference for making their own installations and servicing the appliances themselves because of the better customer contact derived therefrom. At the same time, they welcome any help they can get from both the utility and the appliance manufacturer in solving difficult service problems—the manufacturer, especially, in cases of faulty appliances, and the utility in service after the guarantee period. Many dealers prefer a shorter free service guarantee period than their franchise usually calls for. Yet the majority are disposed toward giving post-guarantee service to good customers.

Summing up, all appliance dealers are prepared for actual selling. In line with this, they maintain that the utility and appliance manufacturer can help them make more sales by giving them accurate, up-to-the-minute local and regional market information, advance knowledge of model and price changes, and pep material for salesmen. They are willing to let bygones be bygones—but first they must be assured of some positive assistance from the utility and the manufacturer, including both the manufacturer's distributor and wholesaler as well.

TECHNICAL TRENDS

by Guy Corfield

Carbon Black From Oil

A DEVELOPMENT THAT may have a profound effect on the utilization and availability of enormous quantities of natural gas has recently been announced by the Phillips Petroleum Co. This is the production of carbon black from oil, by a "Philblack" process.

As is generally known, a very important constituent of many commercial rubber products, particularly automobile tires, is carbon of a particular form and particle size produced from natural gas by the channel-black process whereby the gas is burned and the flame chilled to deposit carbon. This process has always been very inefficient, however, as only about 3% of the carbon in the natural gas is recovered, the remainder being consumed by combustion or lost as smoke. Accordingly, some 10 years ago Phillips Petroleum Co., feeling that a more efficient process was desirable and might become necessary, initiated a program of basic research into production of a satisfactory grade of carbon black from oil, with a more efficient utilization of the raw material.

This research has been successful in developing a process that is 50% efficient in converting the carbon in the oil into a usable form of carbon black at a commercially attractive overall cost. The first successful product, Philblack A, when compounded with normal temperature butadiene-styrene rubber, gave results 85% to 90% as good as those obtained with natural gas channel black. More recently, with the development of low temperature butadiene-styrene copolymer rubber (which has been heralded as an actual improvement over natural rubber) and a modification of Philblack A to what is known as Philblack O, a finished rubber product has resulted which is assertedly superior to the best natural rubber-channel black carbon compounds.

Not only would this seem to put this country in an independent position for good rubber supply but, as mentioned earlier, it may release large quantities of natural gas for purposes other than carbon black production. It is recognized that much of the gas now used for carbon production is "sour" (high sulfur content), but with constantly improving techniques for sulfur removal, this gas may quite profitably be put to efficient use.

Radioisotope Ingenuity

MUCH IS BEING WRITTEN on the possibilities for use of radioisotopes in practically every branch of research and industry; and the increasing variety and availability of products and by-products with radioactive properties, together with an understanding of their safe usage, is increasing the range of application by leaps and bounds.

An ingenious method for testing piston ring wear in engines vs. lubricants and fuels is reported in use by the California Research Corp. (subsidiary of Standard Oil Co. of California). The piston rings are made radioactive, in the uranium chain-reaction pile at the Oak Ridge National Laboratory, and installed in the test engine. Ring wear is determined by the simple expedient of testing samples of the engine oil for radioactivity, and it is stated that as little as one millionth of an ounce of metal worn from the rings can be detected.

Bigger and Longer Inches

ONLY A FEW YEARS AGO we marveled at the Little and Big Inch oil (now gas) lines whose size and length seemed justified and possible only because of national war emergency. Much more recently the Texas-to-California gas line became a reality, with the more than 200 miles in southern California of 30-in. diameter, immediately named the "*Biggest* Inch."

Now comes the announcement of a new gas line, from the Rio Grande river at the Mexican border, to New York City. It will be 2250 miles long of which 1210 will be 30-in. diameter. Presumably it will be "*Longest Biggest* Inch."

Not to be outdone, California is soon to have a second and more northerly gas line, from the mid-continent to the San Francisco Bay area, and it is rumored that the westerly end of more than 500 miles will be 34-in. diameter. What can this be called?

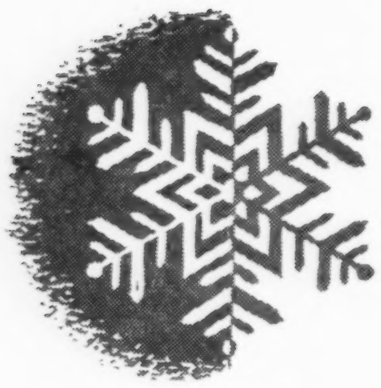
One is reminded of the song from "Oklahoma!" (slightly altered) which goes in part: "What next! What next! Have they gone about as far as they can go?"

Fuel in Remote Future

IN THE LONG RANGE theorizing department the prize seems to go to the Danish scientist who states that the earth's climate is gradually becoming warmer, and that this is caused by the burning of so much coal and oil and gas. He does not claim that the heat produced by this combustion actually makes the world warmer, but rather that the resulting carbon dioxide in the atmosphere close to the earth's surface absorbs increasing amounts of heat from the sun.

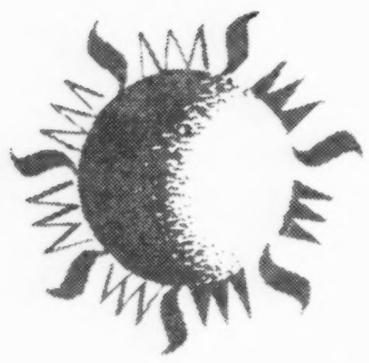
He has calculated that since 1881 the carbon dioxide content of the atmosphere has increased an average of ¼ of 1% per year, and this increase will of course become greater and greater. However, even with fuel consumption double the present rate, the earth's store of coal, oil and gas will last for 4000 years; and by that time the atmosphere will be so warm and steamy as to produce the plant life of the carboniferous age which formed the coal and perhaps the oil which we are now burning.

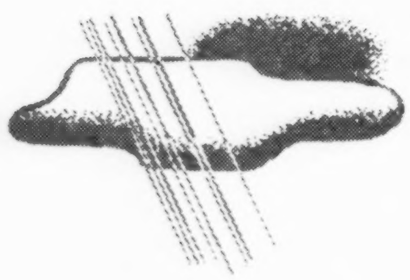
So, with the earth's surface becoming warmer, and the great cycle of nature moving toward replenishment of combustible material, why worry about a future fuel shortage?



Weather presents no problem when NO-OX-IDS are applied to *Protect Pipe* against corrosion

24" pipe, NO-OX-ID protected in the yard, and delivered to the line for stringing and welding.





Regardless of varying temperatures and humidity, you can count on reliable NO-OX-ID to give *stable* corrosion protection to pipe lines.

This illustration is of pipe treated with NO-OX-ID and NO-OX-IDized Wrapper in the pipe yard and now on its way to be laid.

Coatings are dense, flexible. Tough enough to resist zero temperatures without cracking; of sufficiently high melting point to withstand summer suns without flowing.

Average coating thickness is 2/32". Tenacious bond makes it an integral part of the pipe itself and its chemical inhibitors effectively prevent underfilm corrosion.

Water-repellent NO-OX-IDized Wrapper applied over the film gives added corrosion protection, prevents abrasion and soil attachment.

Choose your own method of application . . . by hand or traveling machine . . . winter or summer . . . in pipe yards or on location. We invite you to send for further details.

NO-OX-ID IRON-OX RUST

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THE LEADER IN RUST PREVENTIVES AND BOILER WATER TREATMENT

DEARBORN CHEMICAL COMPANY

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PROMOTIONAL NOTES AND NOTIONS

by Stanley Jenks

Water Heating Program

ONE OF THE THINGS I'm proud of in my utility career is that I was associated with the first successful mass sales campaign of automatic storage water heaters in the manufactured gas industry. (Ninety-five cents per Mcf, 575-Btu gas in those pre-Roosevelt days when a dollar was worth a dollar.)

Therefore, as a pioneer, I have more than a cursory interest in the current "Court of Flame" gas water heater national sales program, sponsored by GAMA under the chairmanship of Jim Donnelly, a former colleague.

This program deserves to succeed—and will succeed, with anything like adequate support in the field. Mind you, there is no evidence to the contrary so far, but—

Well! Is every manufacturer of an approved water heater getting an equal opportunity, or are those units being wholesaled (sic) by the gas company getting the breaks?

Again, some water heater manufacturers—the arrant scoundrels—have had the bodacity (thankee, Snuffy) to make an auxiliary line of electric storage water heaters. We understand such manufacturers find their gas-fired products denied gas company promotional support in certain situations. Incidentally, what happens to those original electric manufacturers, who saw the sweeter fruit on our side of the fence and began to make and promote gas appliances. Are they being blackballed too?

This whole discriminatory attitude is really too silly for words, but, fortunately for our reputation as an enlightened industry, discrimination on this score is the exception rather than the rule.

Mass Approach

SOMEBODY IN THE PROMOTIONAL DEPARTMENT of the Philadelphia Gas Works deserves a lot of credit for a well done cooperative job in the gas heating field. President Hudson Reed can be relied upon to do the honors.

"In Philadelphia nearly everybody reads the *Bulletin*," sloganizes the publisher of the largest evening newspaper in the U.S. I hope this was true of the Feb. 7 issue, because the aforesaid well-done cooperative job fructified in this particular issue.

I counted 60 display advertisements, totalling, according to my count, 461 column inches, devoted to gas heating. The products of five manufacturers were mentioned in 48 of these advertisements, while 10 other dealers, the Retail Merchant Plumbers Assn., and the gas company said their piece in favor of gas heating and volunteered their help to the chilly needy.

It was quite noticeable, and certainly not accidental, that all advertisements stressing one manufacturer's equipment talked about *dependable* gas heat.

The cause of all this commotion was a Philadelphia Gas Works announcement that additional plant capacity would permit a few additional heating installations.

As you know, Eastern manufactured gas companies, with few exceptions, have had to clamp down on new home-heating load because their capacity has been completely sold out pending new facilities.

Rural Service

A FRIEND, who is doing a renovation job on his summer shack by the river, had a problem that all such shack owners must face. He had the conventional 2-wire electric service. An electric hotplate had proved to be completely inadequate. A kerosene stove had been found unsatisfactory, and the seasonal electric service minimum charge for 3-wire service was fairly reasonable if cooking, water-heating, refrigeration, and a spot of space-heating on chilly evenings were provided for. The cost of converting to the 3-wire service and the initial investment in the electric appliances would amount to more than my friend felt he could afford for the usage he intended.

I suggested bottled gas. He said he liked the idea, especially the lower initial investment in appliances and the cheaper operating expense, but his wife was "kinda afraid" of it. A few words from me about the millions of installations beyond the mains and its equal dependability and reliability with that of regular main gas service spurred him (so he said) to insure that a convenient LP-Gas dealer go to work on the hesitant wife. I only hope the seed thus planted will be the beginning of a profitable crop of gas business in this river colony of shacks.

But that dealer will have to "sell" the good lady, who has used gas in her home for years, that her fears of bottled gas are groundless.

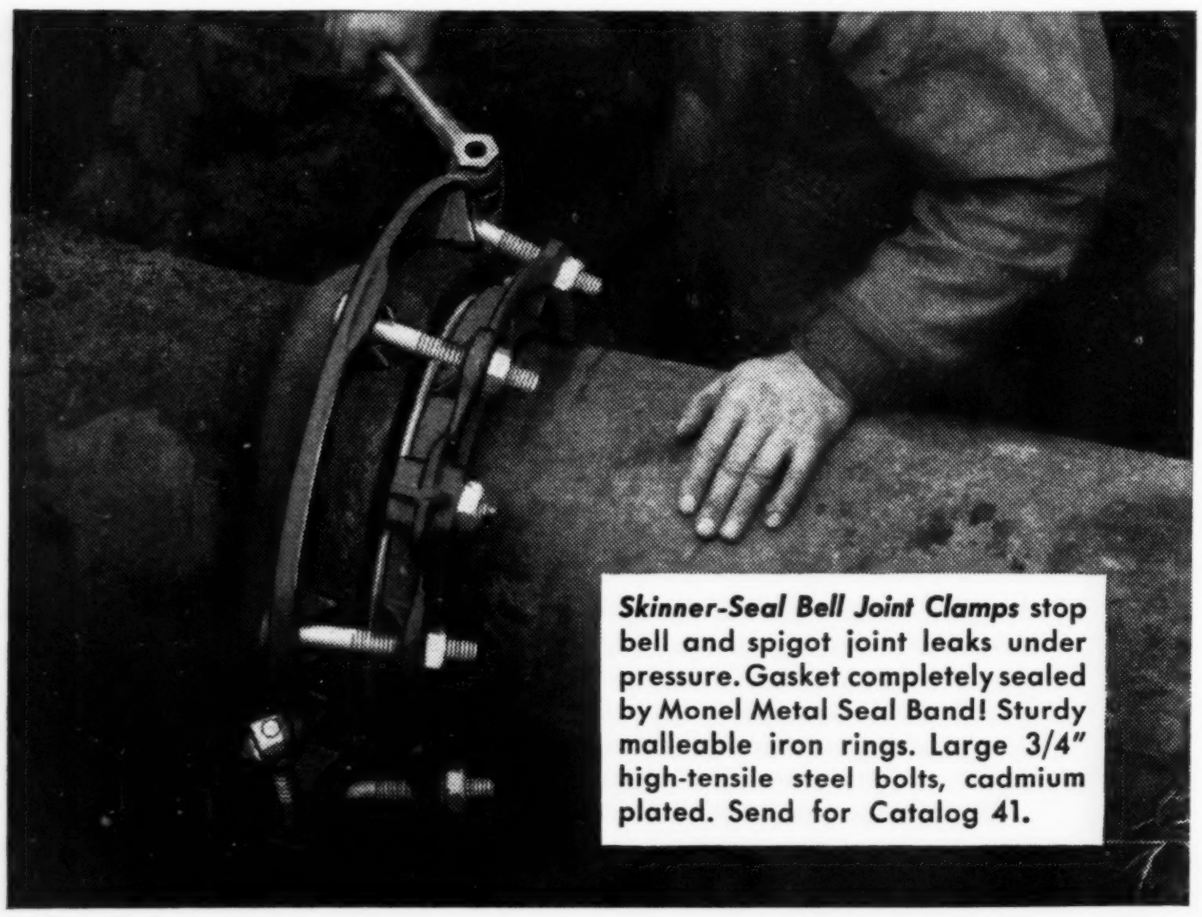
Sales Compensation

THERE MAY BE a few salesmen who work for the fun of it, but all that I have known—good, bad, or indifferent—have always been strictly professionals, money players, and rightly so. Therefore, the method of compensation, because it directs the salesman's efforts, is just as important as the compensation itself. In other words, there are several ways a gas utility salesman can earn, shall we say, $100 a week. His easiest way might produce the least results for the gas company. The gas company, on the other hand, has the right (sez he) to require that it get the most load value for its 100 bucks.

Which leads up to my point that today's utility salesman is there primarily to sell gas and not hardware. His value, therefore, is proportional to the increased gas sales resulting from his promotional efforts in his territory. Since the gas company benefits load-wise from appliance dealer sales, the salesman's compensation plan should recognize this truth, and he should be paid to encourage such sales.

In fact, maybe calling him a "salesman" in itself is psychologically wrong. "Promotional representative" perhaps fills the bill better.

One man repairs broken main!



Skinner-Seal Bell Joint Clamps stop bell and spigot joint leaks under pressure. Gasket completely sealed by Monel Metal Seal Band! Sturdy malleable iron rings. Large 3/4" high-tensile steel bolts, cadmium plated. Send for Catalog 41.

5 TO 15 MINUTES

SKINNER-SEAL SPLIT COUPLING CLAMP makes dependable, lasting repair. One man can install in 5 to 15 minutes! Clamps built to outlast main. Gasket is completely SEALED and protected; at break by Brass Band, at top where compression rings intermesh by Monel Metal Seal Band, at sides by hard vulcanized Gasket Tips.

Insures against recurrence of trouble by introducing a degree of flexibility in the line. Each clamp tests to 800 pounds line pressure. Be prepared — order today. M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL SPLIT COUPLING CLAMP
2" TO 16" INCL.

How 34-Inch Line Will Alleviate Northern California Gas Shortage

By JAMES JOSEPH

AN 1134-mile pipeline approved by the Federal Power Commission on Feb. 28 will move some 250 MMcf of natural gas daily into northern and central California over connecting Pacific Gas & Electric Co. and El Paso Natural Gas Co. systems from the Permian Basin in west Texas and New Mexico. Using 34-in. O.D. steel pipe, it is the largest line ever to be constructed for high pressure transmission of natural gas.

Exclusive

PG&E will construct its 506-mile, 34-in. line from the California border near Topock, Ariz. to Milpitas, Calif., near San Jose, at a cost of approximately $64 million. The El Paso company's 628-mile, 30-in. line from the Permian field will join the PG&E's section at Topock, delivering a daily maximum of 150 MMcf of gas in 1951; 300 MMcf daily in 1952; and some 400 MMcf daily in 1953-54, with further increases possible thereafter.

The 300 MMcf a day due in 1952 amounts to more than half the present average load in the area served by PG&E. The company serves 31 counties in northern and central California, and in 1948 had 884,000 gas customers in 107 incorporated cities and towns, and in some 85 small, unincorporated communities.

San Juan Line Vetoed

At the same time that the FPC approved the joint PG&E-El Paso agreement, it disallowed construction of 449-miles of 26-in. line from the San Juan field in northwestern New Mexico, as proposed in contracts between PG&E and the San Juan Pipe Line Co., whose operations are controlled by El Paso Natural, its chief stockholder.

Actually, because of the commission's refusal to issue a permit for the San Juan line at this time, ultimate delivery under the present authorization will be but 250 MMcf, this amount to be reached by Jan. 1, 1952. However, El Paso has agreed to seek a certificate for an added 50 million by Jan. 1, 1952—"no later than Jan. 1, 1953"—and either a solution to the San Juan difficulties or an agreement to obtain additional gas elsewhere which will bring the ultimate input to 400 MMcf is anticipated.

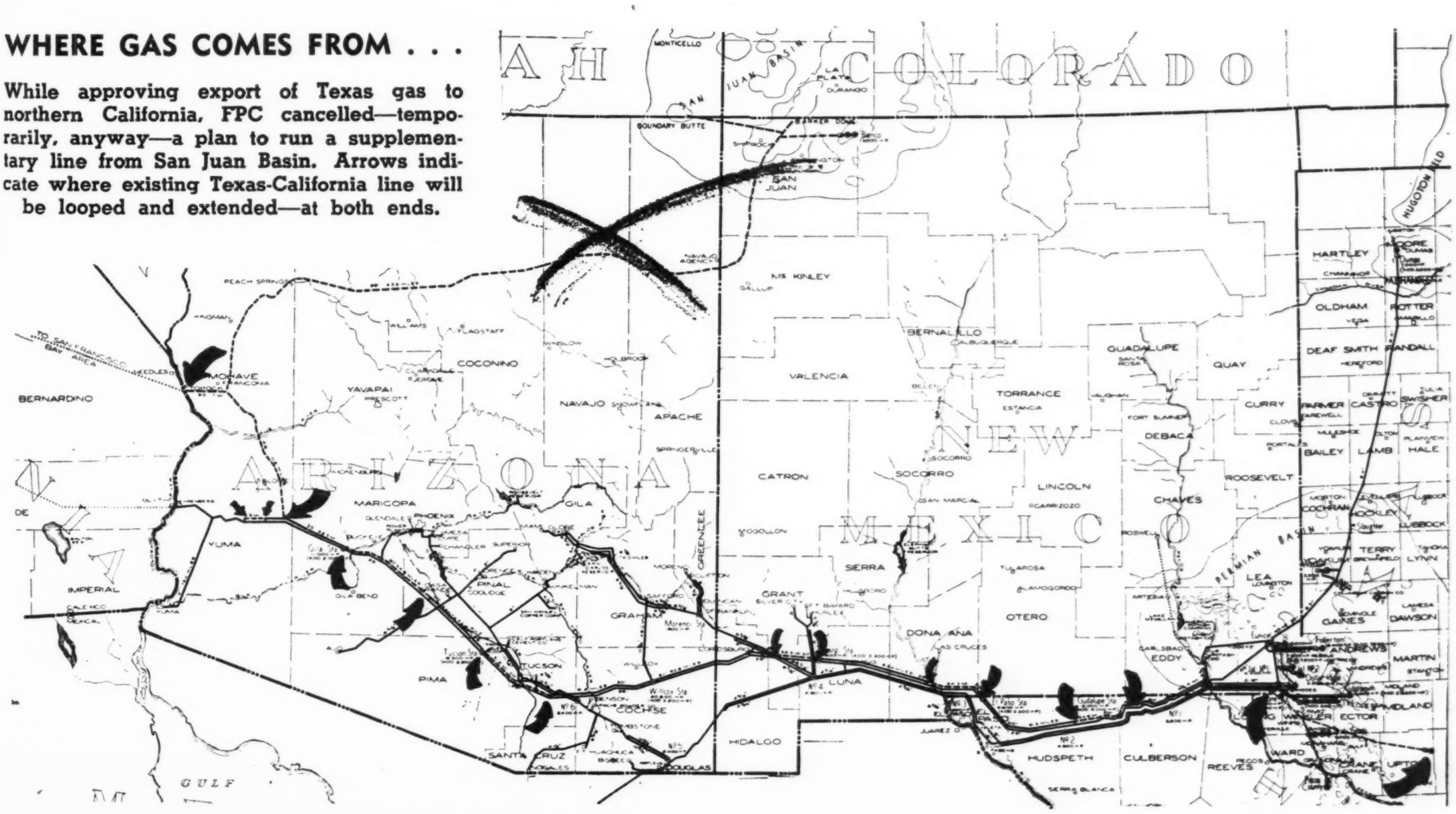
Second Line to West

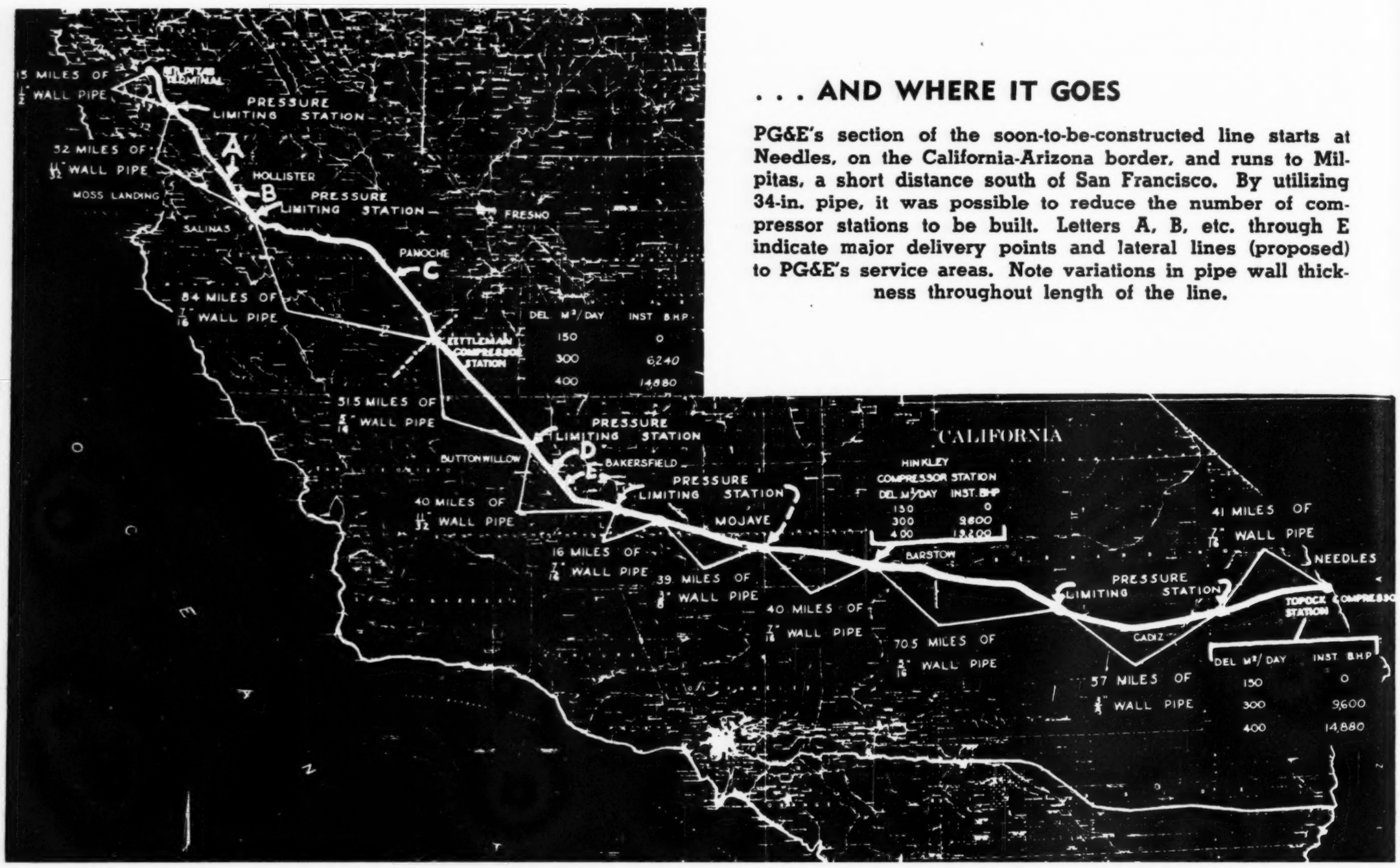
This 1134-mile line will be the second long line bringing out-of-state gas into California. Southern Counties Gas Co.'s 30-in., 1200-mile pipeline now transmits over 300 MMcf of gas daily from the Permian Basin into southern California in agreements with the El Paso company.

PG&E's proposed line would require nearly 200,000 tons of steel and cost $63,321,000 to construct. Annual costs, based upon a 400-MMcf per day delivery at the California border, would reach $31,428,000.

WHERE GAS COMES FROM . . .

While approving export of Texas gas to northern California, FPC cancelled—temporarily, anyway—a plan to run a supplementary line from San Juan Basin. Arrows indicate where existing Texas-California line will be looped and extended—at both ends.





. . . AND WHERE IT GOES

PG&E's section of the soon-to-be-constructed line starts at Needles, on the California-Arizona border, and runs to Milpitas, a short distance south of San Francisco. By utilizing 34-in. pipe, it was possible to reduce the number of compressor stations to be built. Letters A, B, etc. through E indicate major delivery points and lateral lines (proposed) to PG&E's service areas. Note variations in pipe wall thickness throughout length of the line.

The building of the new northern and central California line was approved by the California Public Utilities Commission on Jan. 25, based on the same reasoning which prompted approval of the first out-of-state supply line in 1946.

Out-of-State Gas

PG&E began negotiations for out-of-state natural gas in 1944 when it became evident that California's supplies would be inadequate for future needs. A survey made in connection with application for the Southern Counties line in 1946 showed that there is no known, long-lived, dependable and economical source of natural gas in California which could augment existing supplies—nor provide for increases in future consumer needs—and that major out-of-state sources would be needed.

The FPC decision was based on total supply needs to 1955 presented by PG&E which showed an estimated growth in load of more than 300%. Dry gas, which was a relatively minor source of supply in 1938—only 23 MMcf per day—will rise to a peak 1949 production of 392 MMcf.

Oil well gas production, which supplied 163 MMcf a day in 1938, will decline to 88 MMcf daily this year. More than 99% of the gas supplied to customers by PG&E is natural gas obtained from both dry gas fields, chiefly Rio Vista (*GAS*, Sept., 1946, pp. 41-44) and from oil fields, mainly the Kettleman field, near Bakersfield, Calif. But the availability of oil well gas has decreased steadily since its production peak of 195 MMcf daily in 1941. PG&E showed that it has had to replenish its supplies by purchases from other companies in sharply increasing amounts. In 1947 it purchased 8 MMcf daily from other companies, and just one year later bought 60 MMcf from other concerns, mostly to meet demands and to supplement decreases in the oil well gas supply.

Estimates presented by PG&E indicated that California's gas resources available during 1949 and thereafter will be inadequate to meet total load requirements and that without an out-of-state supply the company could not meet the needs of firm customers which will require 457 MMcf daily by 1955.

In pointing out northern California's expanding consumer needs and the inability of PG&E to meet increased load demands — including interruptibles — the company showed statistics calculated on a peak winter day, Jan. 10, 1949, when weighted mean temperature in the area served was 34.28°F. Even with the company's record send-out of 884,607,000 cu ft, including 34,518,000 cu ft of manufactured gas from its own plants, an additional 280,782,000 cu ft of load was curtailed. Of this, 127,159,000 cu ft was curtailed in the

TABLE 1. ESTIMATED RESERVES AVAILABLE— PERMIAN BASIN

	Estimated reserves 1948 —billion cu ft	Available for performance under contract, 1949-1968 inclusive, in billions cu ft
Eunice, Fullerton, Seminole, Goldsmith	945	396
Drinkard	621	182
Santa Rosa	372	148
Slaughter	811	316
Monument	498	182
Dollarhide	57	54
Monahans	94	63
Benedum	864	808

company's own electric plants and 152,623,000 cu ft in interruptible accounts. On the same day the company purchased 43,172,000 cu ft of "emergency gas" at premium rates from the Kettleman field oil wells.

In approving the PG&E and El Paso proposal, the California Utilities Commission found that "Pacific must augment its sources of natural gas supply quite materially in the immediate future if the demands for such service by its present and potential customers are to be met. The estimates of future loads reflect both the growth of firm demands and the growth of demands for interruptible gas service."

Texas gas, if taken at full rates in accordance with the options provided in the El Paso-Pacific 25-year contract, would constitute a major portion of PG&E's resources by 1954. Without Texas gas the full estimated requirements of PG&E could not be met with the combined estimated in-state resources, and more than half of the interruptibles—257 MMcf daily in 1949 and 363 MMcf daily in 1955—would have to be curtailed under present operations.

Without importation of Texas gas, abnormal peak day requirements would mean curtailment of about 30% during 1951-52 and almost 60% during 1955-56. Implemented by the new 34-in. line. PG&E can reduce peak deficiencies to 17% and 26% respectively.

• FACILITIES TO BE CONSTRUCTED BY EL PASO NATURAL

1. Approximately 95 miles of 24-in. transmission line from Upton county, to Keystone main line compressor station.
2. Approximately 235.0 miles of 30-in. loop line.
3. Approximately 12.3 miles of 26-in. loop line.
4. Approximately 102 miles of 26-in. pipeline from company's 26-in. transmission line to a point near Franconia, Ariz.
5. Approximately 17 miles of 30-in. line from point of junction near Franconia to Colorado river near Needles, Calif.
6. 10,340 additional horsepower in Keystone main line compressor station.
7. Addition of 6000 hp in Guadalupe compressor station.
8. Addition of 2000 hp in Gila compressor station.
9. Addition of 3300 hp in El Paso compressor station.
10. Addition of 3300 hp in Deming compressor station.
11. Addition of 3200 hp in Willcox compressor station.
12. Addition of 2200 hp in Tucson compressor station.
13. River crossings and appurtenant main line and compressor station facilities.

Field Compression, gathering and treating facilities:

1. A total of 49,700 hp of compressors.
2. A total of 95.10 miles of 6⅝-in. to 20-in. pipeline.
3. Gasoline extraction, treating and dehydration facilities.

• FACILITIES TO BE CONSTRUCTED BY PG&E

1. 506 miles of 34-in. diameter pipeline.
2. Compressor facilities consisting of:
   a. Topock Station 7200 hp
   b. Kettleman Station 9600 hp
3. Overhead river crossing of the Colorado river and submerged crossings of the Kern and Mojave rivers.
4. Appurtenant facilities for the above-enumerated installations.
5. Lateral lines consist of:
   a. 28 miles of 20-in. diameter pipeline
   b. 12 miles of 12-in. diameter pipeline
   c. 2 miles of 16-in. diameter pipeline
   d. Meters, regulators, valves, and associated piping to interconnect the 34-in. pipeline with the above pipelines and existing pipelines.

Another factor leading to the California Utilities Commission's contract approval and also to FPC's permit was conservation. The additional PG&E line will further reduce waste of large volumes of Permian Basin gas which otherwise would continue to be vented to the air, despite marketing outlets through Southern Counties' existing 1200-mile line. In the Permian field, spotted with oil fields, a major portion of the gas is produced in conjunction with oil. Previous to construction of the Southern Counties line, some 400 MMcf per day of raw and residue oil-well gas was wasted at wells and gasoline plants.

PG&E estimated that by 1951, when the contract for deliveries takes effect, El Paso will deliver 137 MMcf of gas daily to its lines at the California-Arizona border, with increased deliveries so that by 1955 some 400 MMcf will be delivered daily. The FPC's refusal to approve the San Juan Basin line will call for El Paso's negotiations for additional gas sources to meet its contract. Under presently approved lines it can deliver but 250 MMcf daily. The contract calls for delivery by El Paso of 200 MMcf daily for the first 20 years.

Under terms of the PG&E-El Paso contract, Nov. 30, 1948, a 25-year agreement will come into effect from the time deliveries to PG&E reach a rate of 136.5 MMcf per day (pressure base of 14.9 psi) but El Paso is not obligated to deliver gas in excess of 300 MMcf per day for longer than 15 years. The contract calls for an annual load factor of 91%.

With both northern and southern California drawing from the Permian Basin, estimates were made for a 20-year period, beginning in 1948, as to the extent and productivity of the field. The estimate is shown in *Table 1.*

Facilities which El Paso is authorized to construct will become an integrated part of its existing system. Its present 26-in. line will be completely looped from its Keystone compressor station in Texas to a point 45 miles east of Blythe, in western Arizona.

The 506-mile California system will cross three important rivers—the Colorado, Mojave, and Kern—and will run from Topock, Arizona, northwesterly to the Kettleman field, and thence to the Bay Area terminus at Milpitas, south of San Francisco.

Work to Start in Summer

Bechtel Corp., H. C. Price Co., and Conyes Construction Corp., the successful bidders for construction of the California section, plan to begin work this summer, and subject to delivery of pipe, agree to complete the Milpitas-to-Kettleman City section of 151 miles by Dec. 31, 1949. Bechtel's contract price is $12,225,322 exclusive of "permanent materials"—including pipe—to be supplied by PG&E.

PG&E considered both 30-in. and 34-in. OD as possible pipe sizes, finally decided upon the larger diameter. Specifications call for steel pipe with a minimum yield point of 52,000 psi for wall thicknesses up to and including ⅜-in., 48,000 psi above ⅜-in. and up to and including 7/16-in., and 46,000 psi for thicknesses over 7/16-in.

El Paso will deliver gas at the California boundary at a pressure of not less than 500 psig. PG&E will construct a compressor station at the border to be operated initially at a discharge pressure of 732 psig and ultimately at a discharge pressure of 801 psig. Delivery pressure at the terminus, Milpi-

tas, will be approximately 260 psig.

Lengths of the various pipe-wall thicknesses will be:

15 miles of ½-in. wall thickness; 181 miles of 7/16-in.; 96 miles of ⅜-in.; 92 miles of 11/32-in.; and 122 miles of 5/16-in.

Where the line transverses sparsely populated areas, a maximum working stress of 33,280 psi for wall thickness up to and including ⅜-in. is required; 30,720 psi above ⅜-in. and up to 7/16-in. psi; and 29,440 psi for thicknesses over 7/16-in. The last 15 miles of pipeline, which will pass through heavily populated Santa Clara county, will be designed for a maximum stress of 18,938 psi.

Pipe Fabrication

The contractors will use Consolidated Western Steel Corp. pipe. Consolidated's fabrication of 30-in. pipe for the Southern Counties Gas Co. "Biggest Inch" line brought into production the first west coast manufacture of large-diameter, high strength pipe, and laid the foundation for future large-scale, large-diameter transmission projects. One of the factors influencing the southern companies' decision to use 30-in. instead of 26-in. pipe for the construction of its line in 1946 was anticipated future pipeline needs. Consolidated Western produced 60,000 tons of pipe for the line—over 200 miles—which increased the line's designed capacity to 400 MMcf per day and cut annual operating costs by $200,000.

As soon as the Southern Counties line was completed, Consolidated Western's Maywood, Calif., plant changed over and began fabrication of 30 and 31-in. pipe for the Tapline oil line, which will run 1067 miles from the Persian Gulf to the Mediterranean. This laid the engineering groundwork —perhaps inadvertently—for the presently proposed and approved PG&E line.

Why 34-Inch

PG&E's selection of 34-in. pipe—the largest used for high-pressure lines—was governed by both capital costs and annual operating outlay. Capital costs for transmission mains were not heavily affected by size; the difference between 30-in. and 34-in. was slightly over $2 million. But there was a big saving in using 34-in. when it came to compressor plants and their annual operational costs.

Had the 30-in. line been projected, PG&E would have had to install compressor equipment not only at the border station but also at three other points—Newberry, Arvin, and Kettleman. Using 34-in. pipe, a single compressor station at Hinkley will substitute for the Newberry and Arvin stations, representing a $4 million saving in capital costs and much more annually, when aggregated.

No compressor facilities will be necessary for the initial contractual delivery of 150 MMcf per day. The discharge capacity of the Kettleman compressor station at a 91% load factor for the two delivery rates—either 300 MMcf or 400 MMcf—is estimated as 272 MMcf daily, with a 300 MMcf input, and 359 MMcf for 400 MMcf daily capacity. When deliveries reach 400 MMcf an estimated 9 MMcf of gas will be used daily enroute for compressor fuel.

Horsepower Saving

Using the 34-in. pipe and three compressor stations instead of four, PG&E estimates that compressor capacity at delivery rate of 400 MMcf/day can be maintained with 48,960 hp. To make the same delivery rate through 30-in. pipe would require 62,400 hp.

Unit cost per Mcf of gas delivered at Milpitas, based upon maximum daily deliveries of 400 MMcf at Topock, was another factor in deciding pipeline size. Transportation costs through a 30-in. system would have been 7.52 cents per Mcf; using 34-in., it will cost but 7.06 cents per Mcf, a unit cost reduction on the transportation of gas at the Milpitas terminus of .46 cents per Mcf.

The Permian Basin, which will now, under the new contract, supply both northern and southern California gas needs, raised a marketing outlet problem involving PG&E and Southern Counties Gas Co.

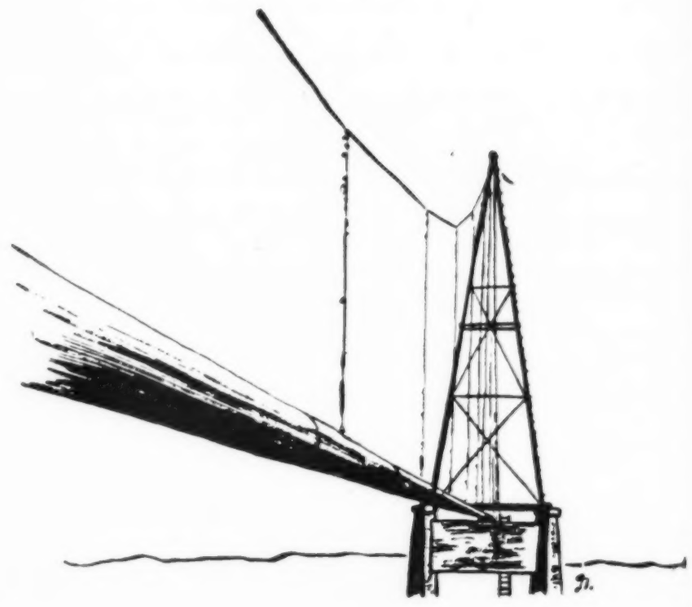
Under a joint pooling agreement between the two California companies, a proration ratio was established by which El Paso will deliver 305 MMcf per day under its previous contract with Southern Counties Co. and 300 MMcf per day to PG&E. El Paso currently delivers natural gas through its company-owned line from natural gas fields at Hugoton, Panhandle, and Permian Basin to Southern Counties. El Paso will now construct its 628-mile, 30-in. connecting line with PG&E—delivering gas at the state boundary at a pressure of 500 psig. Construction costs of this new line were to have exceeded $100 million—that is, including both lines from Permian and San Juan. But the FPC's refusal of the San Juan line will affect this cost figure, lop 449 miles of 26-in. line which was to be the San Juan link, and cause El Paso to look elsewhere in order to meet its contract obligations to PG&E.

Rate Revision

Proposed rates were frowned on by the commission and were not allowed as a part of the certificate. Under the contract, El Paso had proposed to charge Pacific for gas delivered through Dec. 31, 1951, at the rate of 17¼ cents per Mcf, and thereafter on the basis of a demand charge of $1 per month per Mcf of maximum contracted daily demand, plus a commodity charge of 13¾ cents per Mcf. The proposed rates and charges do not reflect the cost of service to be related to either facilities to be used nor operating expense, the FPC ruled. Thus, at least six months before deliveries are to begin, El Paso will have to submit another schedule and cost study.

Specific construction data are not available since all right-of-ways have not been decided upon. Construction of the Milpitas to Kettleman section will start this summer.

One substitution in the original bidder's contract will be the use of glass fabric wrapping, instead of 13 lbs per square felt, over selected sections totaling approximately 30 miles.



Continuous Air Circulation

. . . an attempt to achieve constant temperature

By C. E. RAINSBURY and R. B. CLARK

BEFORE presenting the sequence of steps in adjusting an existing forced warm air installation for Continuous Air Circulation as prescribed by the National Warm Air Assn., we would like to review some fundamentals of heating.

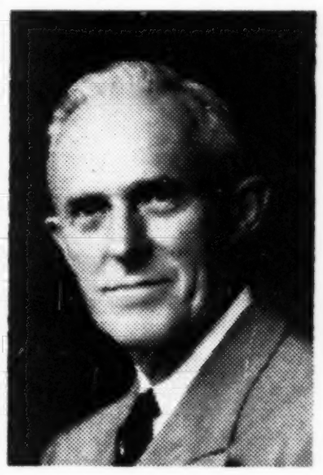
The basic purpose of any heating system is to regulate the heat loss of the human body to its surroundings. This heat loss takes place by means of radiation, convection, and evaporation —and when it is regulated so that it takes place at the proper rate, it produces a sensation of comfort. These rates under normal conditions are 100 Btu/hr by evaporation, 100 Btu/hr by surface convection to the surrounding air, and 200 Btu/hr by surface radiation.

These rates can be varied within reasonable limits as long as their total amounts to approximately 400 Btu/hr. Since heat flow by convection and radiation and evaporation is dependent on temperature difference, it is easily seen that in order to maintain a sensation of comfort in a residence under normal conditions, it is only necessary to maintain a constant temperature in the structure.

Latest Steps

The magic letters, CAC, describe the latest steps that have been taken by the warm air industry in trying to arrive at the constant temperature goal. Of course the control manufacturers have been plugging away at developing better and more sensitive controls in order that we can come closer and closer to this constant temperature goal.

Of course the ideal way of maintaining a constant temperature indoors would be by maintaining a continuous heat input to the structure, that would just equal the rate of heat loss to the outdoors. This would be easy if the temperature difference indoors and out would remain constant. Since Mother Nature sees to it that the outside temperatures fluctuate considerably and hence the rate of heat loss varies, it would seem that our next best bet would be to have a continuous flow of heat input to the structure, but at varying rates, in order to match the varying rates of heat loss. This is what CAC attempts to do.



C. E. Rainsbury

R. B. Clark

HEATING AND AIR CONDITIONING are the specialties of the authors, both of whom are well known to gasmen in the New England area. Mr. Rainsbury has had a long career working for and selling to gas and electric utilities east of the Rockies, and for the past 12 years has been with the Eastern Appliance Co., Boston. Mr. Clark, who is also associated with Eastern, received his mechanical engineering degree from the University of Kansas, later spent eight years with the General Electric Co.

This article was based on a paper presented before the meeting of the heating and air conditioning group of the New England Gas Assn. in Boston last Dec. 10.

CAC, or Practically Continuous Air Circulation, can be obtained by proper adjustment on any automatically fired forced air, or warm air winter air conditioning system, when the control arrangement is of the type where: 1. The room thermostat controls the fire, and 2. The blower control or fan switch in the furnace bonnet, or warm air plenum controls blower operation.

First, the room thermostat should be set at a high temperature so that the burner will operate continuously while the test is being made to determine correct blower speed.

The next step is to check the burner input. On a gas-designed installation where it is thought that the unit has approximately the correct capacity for the job, the input should be that called for on the name-plate of the unit. On other types of installations, or where the burner is somewhat oversized, an approximate setting can be obtained by multiplying the heat loss of the building by 1.5.

After the input has been checked, the high limit control should be checked and set at the usual maximum temperature of 200°. The filters should be checked to see that they are fairly clean, and if the limit control has a differential setting, it should be adjusted for a minimum differential.

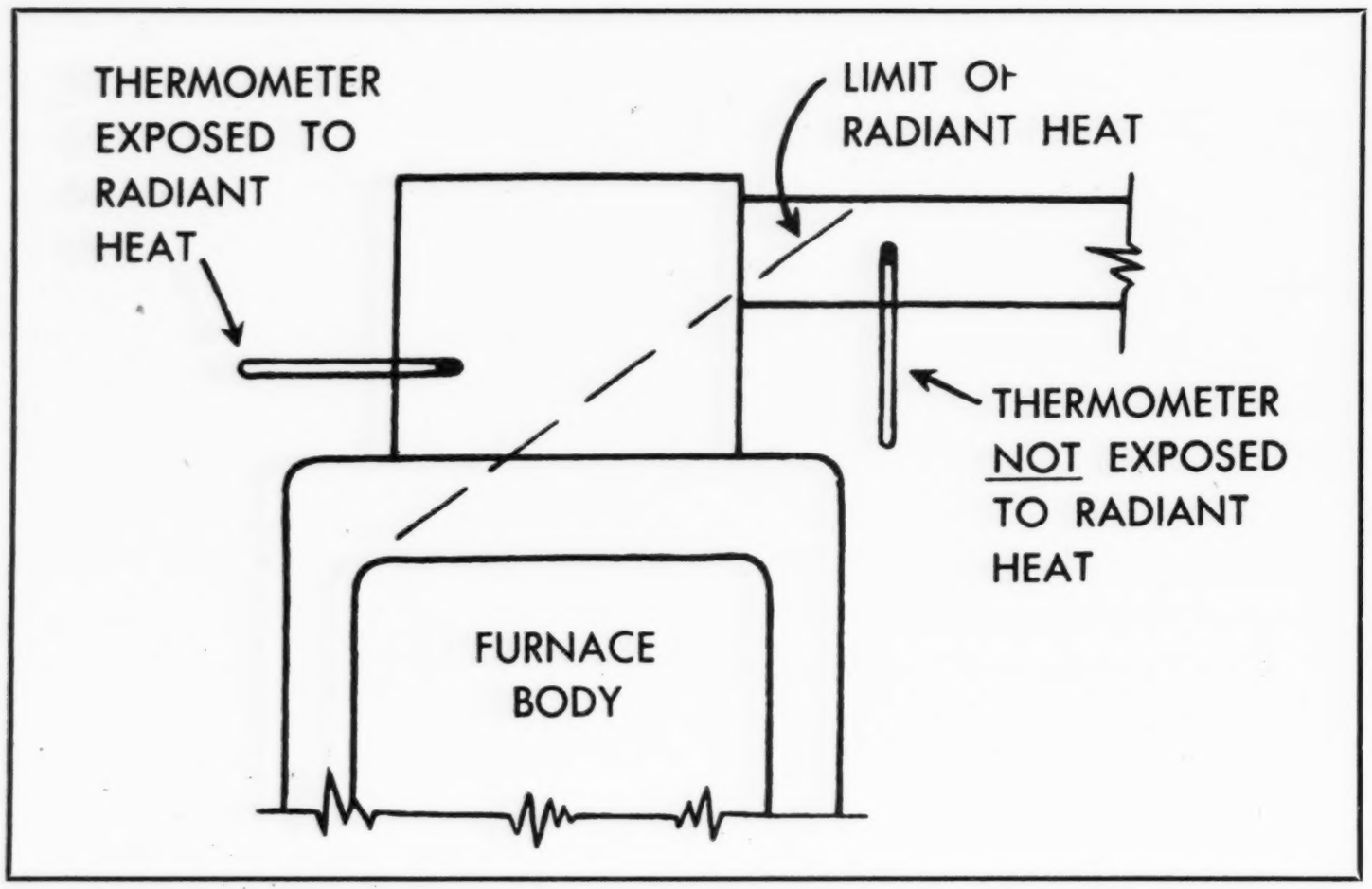
With the fan switch set at the lowest possible temperature to insure continuous blower operation, we now check the temperature rise of the air passing through the furnace. During this step all registers and duct dampers should be in their normally open position, and the filters should be reasonably clean so as to represent average condition of air flow through the system.

The temperature rise that we are to determine is the difference between the temperature of the warm air leaving the furnace and the return air entering the blower compartment. To make the check, all we need for equipment is a testing thermometer with a range up to 200° F and a scratch awl, or similar sharp tool, to make a hole in the return air duct and warm air plenum chamber for insertion of the thermometer. Care must be exercised in choosing the location for obtaining the warm air temperature to make sure that the thermometer is not exposed to radiant heat rays from the heat exchanger.

Heat Levels Off

After the burners and blowers have been operating a short time, you will find that the temperature of the warm air leaving the furnace will level off. For continuous air circulation it is our desire that this temperature be 100° higher than the return air temperature.

On a job which has not previously been adjusted for continuous air circulation (and few plants have been so adjusted) the temperature of the air leaving the furnace bonnet is almost always less than 100° above the return air temperature, and this is due to too high a rate of air circulation. In order to get our 100° rise, it is, therefore,



Proper insertion of thermometer in main warm air duct is important. It should be near the furnace but far enough away so that radiant heat from the furnace body cannot "shine" on thermometer bulb when it extends 2 or 3 in. inside duct.

necessary to slow the air movement down by reducing the motor pulley diameter, increasing the blower pulley, or installing a special damper in the return air duct. If it is necessary to install a damper it should be of the lock type and should be smaller than the return air duct, so that when it is fully closed it cannot completely cut off all air flow.

Setting Fan Switch

After we have made the necessary adjustments to obtain the 100° rise, our next adjustment is setting the fan switch. The fan switch differential should be set for a minimum value, and then the cut-out point should be set to stop the fan at a bonnet temperature as low as 5° above the desired room temperature if possible, as measured by the thermometer in the warm air plenum chamber. On most jobs a desirable differential seems to be 15°, and this would mean that you would set the fan to come on at about 95°, and shut off at 80°, instead of your old settings of approximately 140° cut-in and 115° cut-out.

Of course each installation must be considered individually and even with the blower speed reduced on some installations, there may be an uncomfortable feeling of air movement in the rooms if the blower continues to run until the air leaving the register is practically as low as the room temperature. It depends on register types and locations, and, of course, would be aggravated by an oversized furnace and blower installation. Each job is a problem in itself and the best cut-off point should be just as low as possible without discomfort, and it can be much lower at the slower blower speed.

The procedure for setting the fan switch is to set the room thermostat at its lowest setting so that the burner will remain off while we are making the adjustment. With the burner off, set the fan switch for its lowest setting and allow the fan to run until our thermometer in the warm air plenum shows between 75 and 80°. Now, inch the fan switch up until it turns the blower off. This is the desirable setting, provided it doesn't give discomfort due to air movement. If this setting does give discomfort, then raise the setting in 5° steps, until it is satisfactory. *Do not raise the temperature any higher than is necessary.*

The next to the last adjustment for continuous air circulation is to set the room thermostat differential for approximately 1 to 1½°. Unless the thermostat on the job is of the heat accelerating, heat anticipating, or other highly sensitive type which operates or can be adjusted to operate within 2°, then maximum satisfaction cannot be obtained. However, it should be kept in mind that the adjustment should not be so close that the on cycle of the burner will be shorter than 2 min.

The last adjustment, of course, is the final balancing of the system, to correct any rooms that are not being maintained at the same temperature as that in the room where the thermostat is located. This balancing is easily done by means of thermometers in the room, and opening or closing dampers in the ducts leading to these rooms.

Now that these adjustments are completed, the plant is set up for "Continuous Air Circulation." Briefly, the plant will now operate as follows when using a standard type thermostat.

With the outside air temperature above 40°, there will be intermittent operation of the burner and the blower. After the outside air temperature drops below approximately 32°, there will be nearly continuous blower operation with intermittent burner operation. By the time the outside air temperature reaches 0° (or the outside design temperature), the blower and burner will be operating continuously, provided the furnace has been sized properly.

At this point a word of caution in regard to installations having clock-type thermostats and where the customer is in the habit of setting back the standard thermostat during the night. As was said earlier, the ideal job would be to have the burner run constantly, with input following the weather requirements. This being impractical, the nearest approach is to accomplish this in severe weather; and by rapid cycling of the thermostat in mild weather to modulate the output temperature of the air within practical limits.

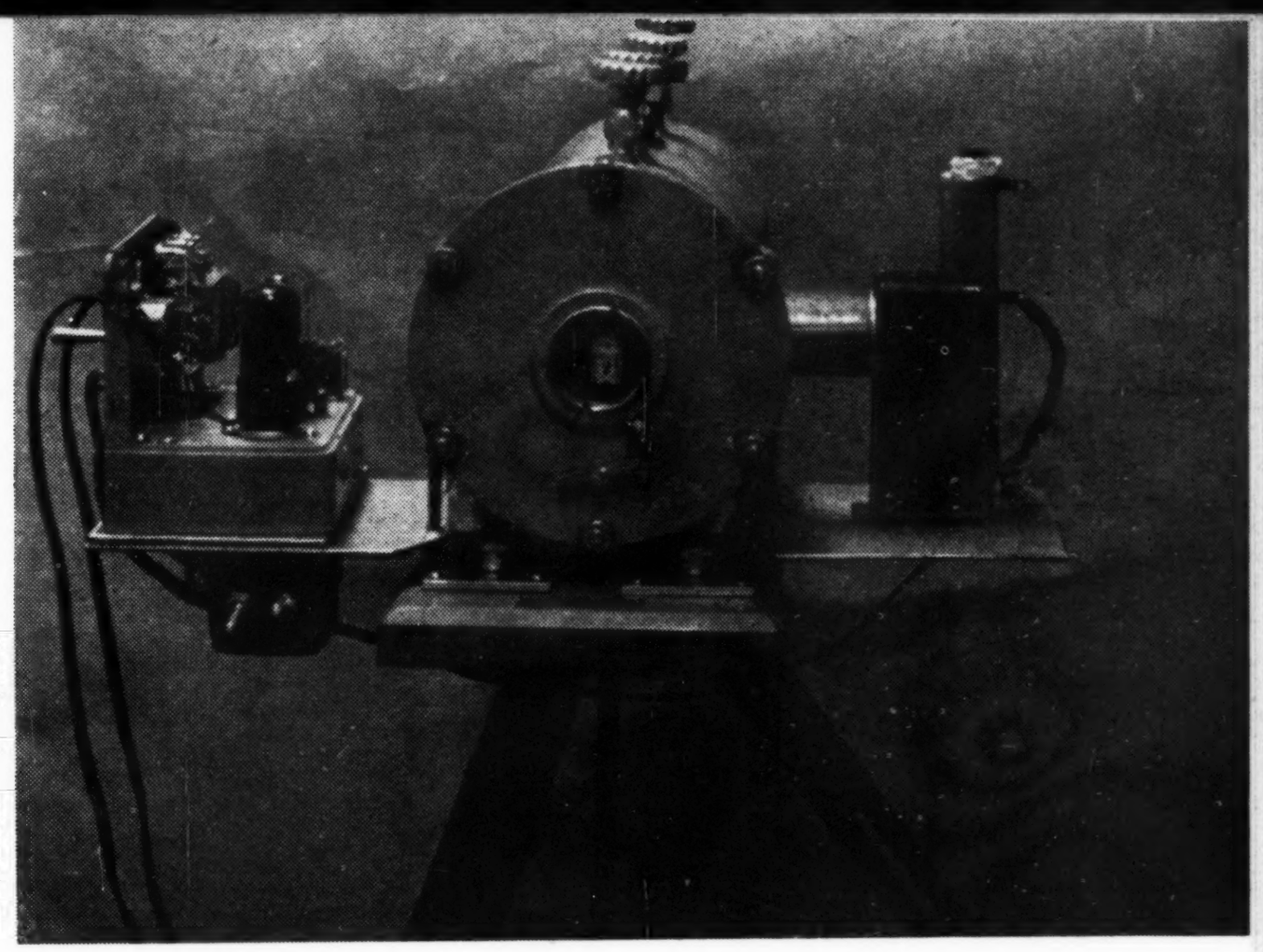
By adjusting the input as recommended by CAC to 1.5 times the building heat loss, you will have nearly constant operation of the burner in severe weather. While this adjustment will give plenty of surplus heat for morning pickup in mild weather, it doesn't leave you much for severe weather, and it will be necessary to point this out to the customer so that he can take steps to have the unit come on a little earlier in severe weather, or so he can cut down the amount he sets the temperature back in severe weather.

Review of Benefits

In conclusion, a quick review of the advantages of the Continuous Air Circulation adjustments:

1. Comfortable uniform warmth from floor to ceiling, and from room to room, for the whole heating season.
2. Almost complete elimination of all fan noise complaints due to air flow and vibration, because of the lower air velocities and fan speed.
3. Correction of "Cold 70°" complaints during blower-off periods, particularly during mild weather.
4. In most cases, elimination of cold drafts immediately after blower starts and expells the cool air in the ducts, because of the lower air velocities.
5. Less tendency to distribute dirt.
6. Possible reduction in fuel consumption, due to lower average temperature, and steady temperature in the house due to the lower furnace temperature during blower off periods.

Gravity Balance Detects Oxygen In Gas Stream



The oxygen detector is designed to detect the presence of air in the gas stream, and then shut off the flow.

CONTRARY to an idea that once existed among uninformed consumers, you can't dilute natural gas with air like adding water to milk to make it go further. In fact, every possible precaution must be maintained to keep oxygen out of pipelines—gas without oxygen is not combustible; but a proper gas-air mixture requires only a spark to produce an explosion that can rip a pipeline, compressor or meter station apart.

This explains the need for purging pipelines after each shutdown for repairs. It also emphasizes the value of the J. R. Bird Oxygen Detector, recently developed by J. R. Bird and the United Gas Corp.'s gas measurement department, and later modified and improved by the research department of that company.

The oxygen detector is an apparatus designed to detect the presence of air in the gas stream and to close a valve automatically, shutting off the flow. It is essentially an Ac-Me gravity balance in which an additional view lens has been mounted on each side of the cylinder.

A photoelectric light source is mounted on one side of the gravity balance cylinder in such manner that the light beam can be directed through the cylinder and the two lenses to a photoelectric relay unit mounted on the opposite side of the cylinder. The electrical control circuits in this relay operate a solenoid valve which in turn controls other valves.

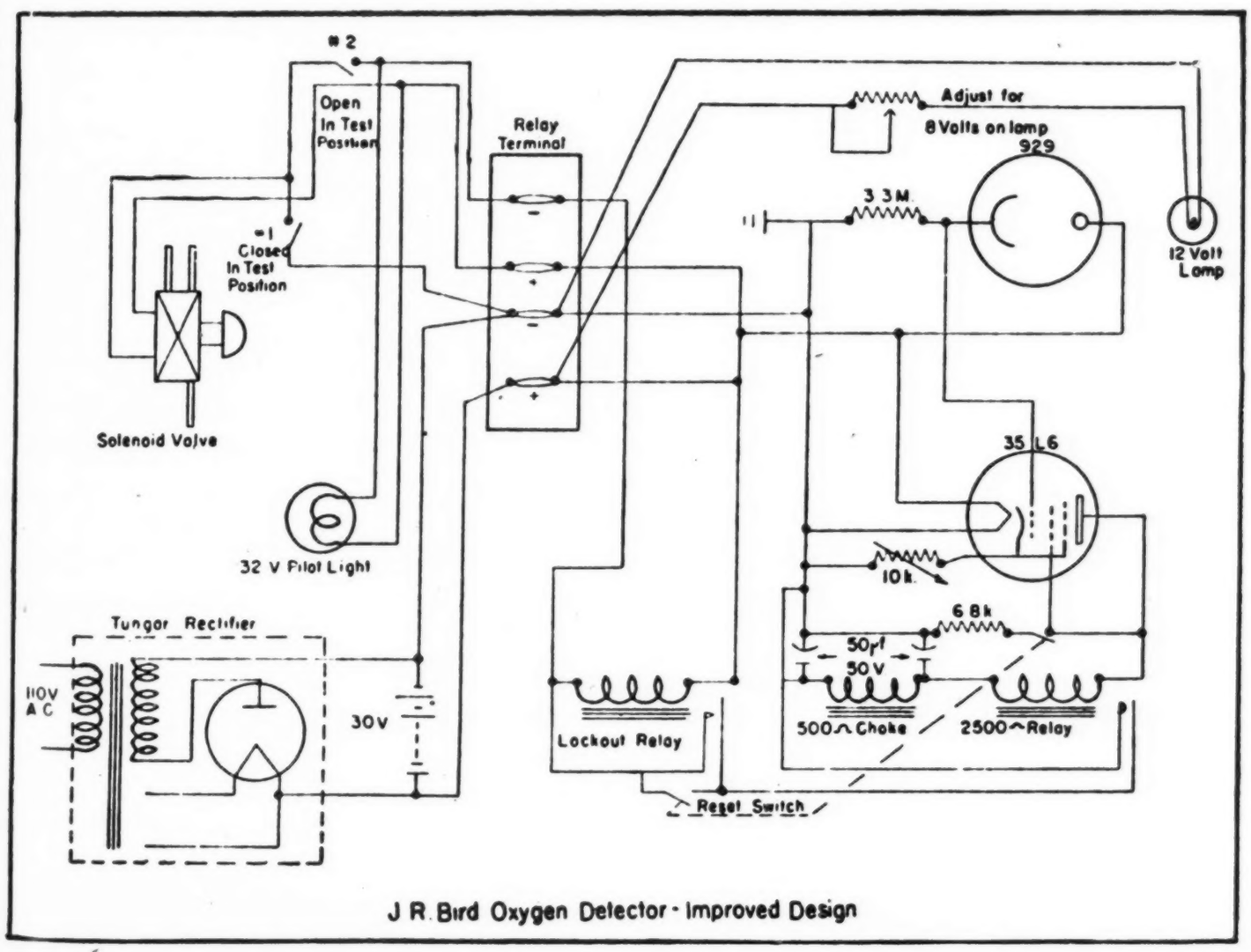
The control functions of the relay are actuated by a target attached to the gravity balance arm in such manner as to cut the light beam passing through the cylinder at a predetermined setting. In order to insure operation of the oxygen detector independent of power line failures, it is essential that it be battery operated.

In some areas where gas well pressures have declined, field compressor units are necessary. It is easily understandable how such a unit might pull a near vacuum on a field pipeline, and how any small opening in the line would then induce the entrance of outside air to create a hazardous condition.

Such conditions have long been the subject of concern, prompting the study and experimentation through which the oxygen detector was developed. A previous method of detecting the presence of oxygen in gas employs the use of the Thermeter. However, due to the time lag in this instrument together with a lack of dependability resulting from current interruptions, a more practical method was needed; and attention was turned to the gravity balance which reacts simultaneously to any change in the specific gravity of gas and has no electric motor to be kept in operation.

When air gets into the gas stream, the heavier specific gravity is detected by the gravity balance, the balance arm moves to cut the light beam and the electronic activity is set in motion, closing the electrically operated (solenoid) valve to effectively prevent the movement of oxygen through the pipeline system.

The oxygen detector was placed in regular service May 4, 1948, in the Hull-Silk field of the Wichita Falls district, where operation of the instrument has been highly satisfactory. No adjustments to the equipment were necessary in spite of hauling and handling, a feature which demonstrates its ruggedness of design.



J R Bird Oxygen Detector - Improved Design

Reprinted from *United Gas Log*, employee publication of United Gas Corp., Shreveport, La., and affiliates.

Second Underground Gasification Project Starts

Alabama Power Co. and U. S. Bureau of Mines experts seek to obtain gas of higher Btu content than was made in 1947 experiments.

By E. G. DAHLGREN

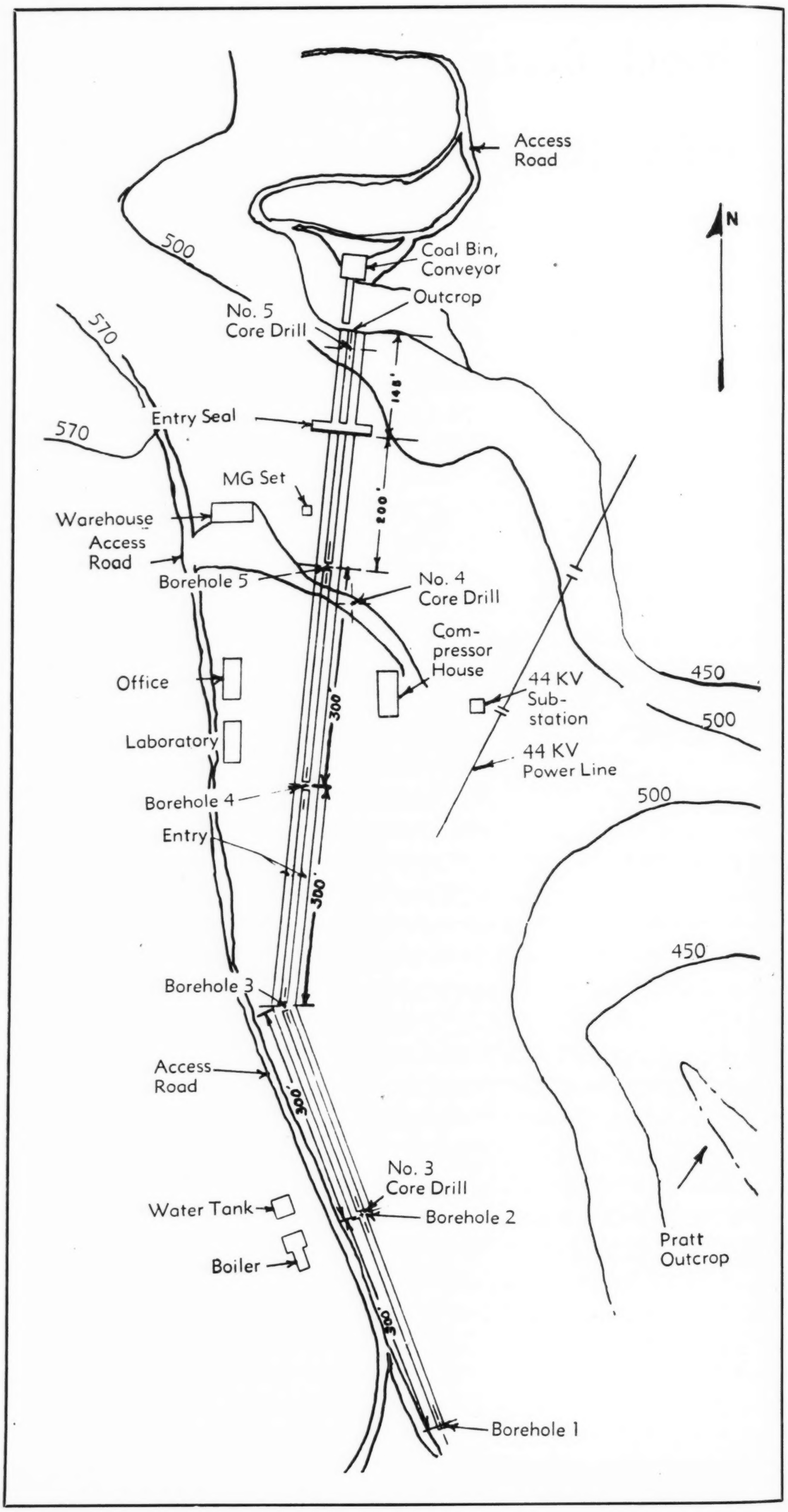
AN incendiary bomb was scheduled to be dropped March 15 into the coal bed to start the fire for the second underground coal gasification experiment at Gorgas, Ala. This experiment is being conducted by the United States Bureau of Mines in cooperation with the Alabama Power Co. in an area of approximately 100 acres of Pratt seam coal averaging 44 in. in thickness near the site of the initial underground coal gasification experiment conducted jointly by the bureau and the power company in 1947. The cost of this large scale experiment will be approximately $411,000 for a one-year period.

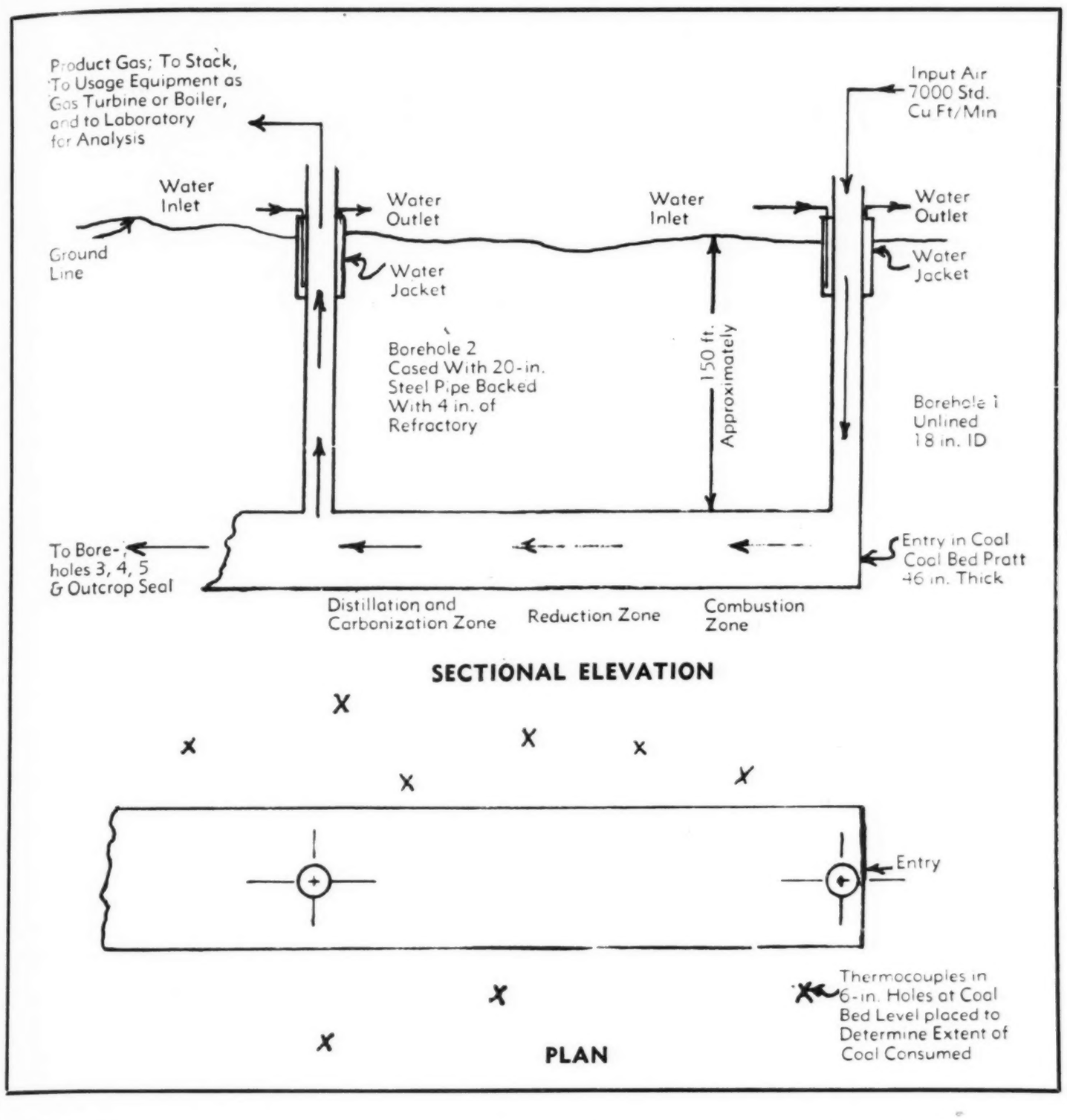
Exclusive

Preliminary work consisted of core drilling to determine the composition of the ground overlying the coal which ranges from 60 to 125 ft in depth; the drilling of five large diameter holes to the coal bed and the driving of two parallel entries from the coal outcrop into the bed for a distance of 1200 ft and a single butt entry for an additional 300 ft.

The objectives of the experiment are:

1. To determine the quantity of coal which can be gasified from a given combustion zone and the shape and extent of the burned-out area formed.
2. To determine whether fixed outlets for product gas are practicable, either at the outcrop of the coal bed or at vertical bore holes. Various designs of inlets, outlets, and seals will be tested.
3. To determine the operating characteristics of the installation under a variety of conditions.
4. To determine the quality and quantity of product gas generated with an air blast under experimental conditions and, secondly, the quantity of tar and related products obtained.




Product Gas; To Stack, To Usage Equipment as Gas Turbine or Boiler, and to Laboratory for Analysis
Input Air 7000 Std. Cu Ft/Min
Water Inlet
Water Outlet
Water Inlet
Water Outlet
Ground Line
Water Jacket
Water Jacket
Borehole 2 Cased With 20-in. Steel Pipe Backed With 4 in. of Refractory
150 ft. Approximately
Borehole 1 Unlined 18 in. ID
To Bore-holes 3, 4, 5 & Outcrop Seal
Entry in Coal Coal Bed Pratt 46 in. Thick
Distillation and Carbonization Zone
Reduction Zone
Combustion Zone
SECTIONAL ELEVATION
Entry
Thermocouples in 6-in. Holes at Coal Bed Level placed to Determine Extent of Coal Consumed
PLAN

AT LEFT is shown the plant layout.

ABOVE is a schematic diagram of the gasification project at Gorgas, Ala.

5. To obtain information on the effect of heat on the overlying strata.
6. To obtain fundamental technical and economic information concerning plant sites, installations, and operating processes.

In designing the second project, factors pertinent to the design of an underground gasification installation were studied carefully. These included gas-making reactions, geology of the coal-bearing strata, and methods of driving underground passageways, drilling boreholes, and handling, purifying, and utilizing product gas. These studies, together with the experience gained in the first field-scale experiment, determined the design of the experimental unit now being constructed.

The first project in 1947 produced encouraging results. It was shown that combustion could be maintained and controlled, that coal in place could be gasified completely, and that the roof rock would become plastic, expand, and settle down behind the burning coal face without cutting off the air or gas. The gas obtained, however, was of lower heating value than desired. This was attributed to leakage of gas and air pressure through cracks and breaks in the thin (30 ft) cover over the burning coal seam.

To correct this fault, the new experiment will be carried out at a much deeper level—100 ft or more—and with much heavier air pressures and higher temperatures. These factors are expected to increase the average heat value of the gas produced with an air blast from the 47 Btu/cu ft obtained last year to from 75 to 125 Btu.

Although of lower heating value than normal commercial gas, the product resulting from the first experiment was burned successfully under a boiler. If available in quantity, it could be used to make electric power and for other industrial heating fuel requirements. If gas is produced with constancy, as to quality and quantity, it is planned to operate a gas turbine which the bureau has on hand at Gorgas with the gas thus produced. If heating values can be improved materially, underground gasification offers a cheap source of synthesis gas—carbon monoxide and hydrogen—the number one problem in making synthetic liquid fuels manufacture an economic operation.

Milton H. Fies, consulting engineer and manager of coal operations for Alabama Power Co. and James Elder, chemical engineer, bureau of mines, are in charge of the current experiment. Under their plans the parallel entries in the coal bed have been connected by a crosscut every 300 ft. At the center of each crosscut and at the end of the butt entry, a large diameter vertical bore hole will connect with the surface. A refractory-type fixed gas outlet and seal have been constructed at the entry portals, and the vertical bore holes also have been sealed at the surface and fitted with pipe connections for attaching the air source and product gas incinerators, or gas-usage equipment.

When the coal was ignited by the incendiary bomb as in the first experiment, air was forced down the bore hole under pressure by an electrically driven reciprocating compressor with a capacity of 7300 cu ft/minute at 30-lb pressure. Gases will be drawn off at the next bore hole or one farther down the entry if desired. Temperature and pressure measurements taken at small test holes offset from the line of the entry will determine the progress of the fire.

If the coal burns out between the bore holes in a cigar-shaped cavity, additional bore holes will be drilled from the surface to the widest points of the cavity curves. These holes, in turn, will be connected to the system as air inlets. In this manner, the possibilities of using a vertical bore hole system to propagate the gasification over a tract of coal land will be determined. If unsuccessful, a parallel entry system or a modification thereof will be employed to continue the combustion.

In a recent address at Birmingham, Ala., Dr. W. C. Schroeder, chief, office of synthetic liquid fuels, bureau of mines, stated, "It is possible to partially burn (gasify) the coal underground, bring the gases to the surface, and then convert them to oil and gasoline. It is this bold step, with breath-taking promise in the elimination of the underground labor of mining, which has attracted the attention of the world to the experiments now going on at Gorgas, Ala."

An office building, laboratory, and a warehouse have been erected on the site. A building has been constructed to house the compressor, blowers, and their electrical controls.

To provide the water needed, a 150-gal/min, 400-ft-head, centrifugal pump has been installed on the Warrior river, approximately ¾ mile from the site of the experiment. Water is required for cooling the product gas, the water-jacketed bore hole seals, and the compressor, and for miscellaneous purposes.

Reserves Report: 174 Trillion Cubic Feet

ESTIMATED PROVED RECOVERABLE RESERVES OF NATURAL GAS

(Millions of Cubic Feet—14.65 psia, at 60°F)

	CHANGES IN RESERVES DURING 1948 (b)				RESERVES AS OF DECEMBER 31, 1948 (b)				
	Reserves as of 12-31-47	Extensions and Revisions	Discoveries of New Fields; New Pools in Old Fields	Net Change in Underground Storage (c)	Net Production (d)	TOTAL	Non-Assoc. (e)	Associated (f)	Dissolved (g)	Underground Storage (h)
Arkansas	890,149	73,969	3,484	(-) 10	65,754	901,838	457,906	161,919	280,568	1,445
California	10,164,356	498,673	111,257	(-) 2,699	578,994	10,192,593	2,911,991	3,052,802	4,215,775	12,025
Colorado	331,886	621,577	408,148	.....	12,412	1,349,179	586,757	40,939	721,483	.....
Illinois	221,131	43,310	.....	.....	36,637	227,804	7,967	20,000	199,837	.....
Indiana	13,000	14,104	.....	.....	5,504	21,600	6,000	.....	15,600	.....
Kansas	14,556,916	124,304	2,385	1,213	276,986	14,407,832	13,959,636	210,292	211,035	26,869
Kentucky	1,379,480	69,775	9,000	7,896	88,000	1,378,151	1,295,122	.....	73,000	10,029
Louisiana	23,481,233	532,638	722,859	.....	759,210	23,977,520	18,909,691	3,490,004	1,577,825	.....
Michigan	168,469	14,490	11,705	10,461	22,138	182,987	121,502	.....	45,876	15,609
Mississippi	2,452,760	54,413	52,423	.....	55,260	2,504,336	1,743,948	464,632	295,756	.....
Montana	700,510	189,244	1,966	1,575	40,690	852,605	485,030	337,121	28,879	1,575
New Mexico	5,990,283	(-) 214,670	108,930	989	279,171	5,606,361	2,824,102	1,991,862	786,557	3,840
New York	64,900	4,098	.....	3,073	4,456	67,615	59,720	.....	725	7,170
Ohio	611,200	57,780	7,880	13,325	60,732	629,453	542,608	.....	38,500	48,345
Oklahoma	11,350,864	447,543	208,636	(-) 283	674,315	11,332,445	7,660,624	1,125,136	2,534,088	12,597
Pennsylvania	483,063	182,967	12,000	13,972	74,592	617,410	530,721	.....	45,750	40,939
Texas	90,025,566	6,563,060	1,830,349	.....	2,710,422	95.708,553	68,663,367	16,725,023	10,320,163	.....
Utah	66,670	.....	10,000	.....	6,872	69,798	69,798	.....	.....	.....
West Virginia	1,780,735	123,462	37,000	1,970	206,000	1,737,167	1,622,235	.....	89,500	25,432
Wyoming	1,191,788	363,063	588,067	.....	49,178	2,093,740	927,796	257,308	908,636	.....
Misc. (a)	1,975	5,683	3,000	.....	305	10,353	7,993	.....	2,360	.....
Total	165,926,914	9,769,483	4,129,089	51,482	6,007,628	173,869,340	123,394,514	27,877,038	22,391,913	205,875

(a) Includes Alabama, Florida, Missouri, Nebraska and Virginia
(b) Excludes shrinkage caused by natural gas liquids recovery
(c) The net difference between gas stored in and gas withdrawn from underground storage reservoirs
(d) Net production equals gross withdrawals less gas injected into underground reservoirs; changes in underground storage are excluded
(e) Non-associated gas is free gas not in contact with crude oil in the reservoirs
(f) Associated gas is free gas in contact with crude oil in the reservoirs
(g) Dissolved gas is gas in solution with crude oil in the reservoirs
(h) Gas held in underground reservoirs for storage purposes only

DISCOVERIES, extensions, and revisions of previous estimates of natural gas reserves continued to outstrip production during 1948, with the result that proved reserves increased by almost 8 trillion cu ft.

So spoke the American Gas Assn. committee on natural gas reserves last month in submitting its fourth annual report.

The net total, therefore, now stands —as of Dec. 31, 1948—at 173,869,340,000 cu ft.

Thus the committee continued to record steady gains since the inception of the study in 1945. From that year's end, when the experts came up with a figure of 147 trillion—nearly 148—an aggregate increase of 25 trillion has been chalked up. This heartening record has been achieved in the face of unprecedented production, which over a period of three years has siphoned some 16½ trillons out of the ground.

New Procedure

A hint of trends on industry thinking is contained in a new procedure which has been incorporated in the study for the first time this year, the inclusion of volumes in underground storage. Although numerically insignificant in 1948—51 billions, or less than ½ of 1% of the total—these stores may one day form a sizeable bulk in the total of available natural gas.

The committee explained its action in accounting for underground storage in this way:

"The committee has included in this report for the first time a study of the natural gas *located* in underground

NATURAL GAS LIQUIDS RESERVES REPORT
(Bbl. of 42 U. S. Gal.)

Total proved reserves as of Dec. 31, 1947		3,253,975,000
Extensions and revisions of previous estimate	405,874,000	
New reserves discovered in 1948	64,683,000	
Total proved reserves added in 1948		470,557,000
Total proved reserves as of Dec. 31, 1947 and new proved reserves added in 1948		3,724,532,000
Deduct production during 1948		183,749,000
Total proved reserves of natural gas liquids as of Dec. 31, 1948		3,540,783,000

storage reservoirs. The 'stored gas' is considered to be the gas which has been transferred from its original location in a gas and/or oil field to another natural underground reservoir for the primary purposes of conservation, fuller utilization of pipeline capacities, and more effective delivery to markets. The 'stored gas' reserve is the quantity which has been placed in a natural reservoir and not yet removed. Any additional recoverable gas which may have been in the underground storage reservoirs when injection was begun, and has not yet been produced, is classified in its proper category and listed as in the committee's earlier reports. The distinction is now made between 'production' of gas from its original reservoir and 'net change in underground storage.'"

Liquids

Concurrently with its report on the reserves of gas itself, the committee released its annual survey of natural gas liquids, which also reflects healthy increases in totals. Over 286,000 barrels were added to proved stocks during 1948, an increase which more than tripled the previous year's boost. In clarifying its definition of "natural gas liquids" the committee had this to say:

"In its report of Dec. 31, 1946, this committee defined natural gas liquids as '. . . those hydrocarbon liquids that are gaseous in the reservoir but are obtainable by condensation or absorption. Natural gasoline, condensate, and liquefied petroleum gases fall in this category.' In order to prevent misunderstanding of this term it is further amplified as follows: The natural gas liquids are those heavier hydrocarbon components of the natural gas which are removed and reduced to the liquid state by various processes. These processes usually take place in the field separator, scrubber, gasoline plant, or cycling plant. The liquids so collected and the products made from them in some of the modern plants are known by a variety of names, but they have been grouped together here under the general heading 'natural gas liquids.'"

Quoting the committee further in its explanation of procedures followed:

"The committee emphasizes again that it is not possible to estimate the total reserves of a field in the year of discovery. Satisfactory estimates can be made only after sufficient development of the field, and, in some cases, adequate production history. For these reasons, the reserves listed as discovered during any current year must be considered only as the reserves indicated by the drilling in that year. The estimated reserves of these new fields and pools will be revised in future reports and shown as 'Extensions and Revisions.'

Explanation

"The procedures followed in arriving at and assembling the reserve figures were the same as those used in past reports. The proved reserves may be in either the drilled or undrilled portion of a given field. Where the undrilled areas are considered proved. they are so related to the developed acreage and to the known field geology and structure that their productive ability is considered assured. Recoverable reserves of natural gas are the reserves estimated to be producible under present operating practices. Since the estimates are made by fields, the recovery factors or abandonment pressures used in the calculations were determined by the operating conditions of each individual field. Proved recoverable reserves of natural gas liquids are those contained in recoverable gas reserves and extractable by methods now in use."

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American Gas Assn.
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COMPARISON OF ESTIMATES FROM 1945 THROUGH 1948

Year	NATURAL GAS ADDED DURING YEAR: Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions & Extensions	Net Change in Storage	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1945	.....	.....	.....	.....	.....	147,789,367	.....
1946	(a)	(a)	17,729,152	(a)	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	(a)	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426

(a) Not estimated.

Year	NATURAL GAS LIQUIDS ADDED DURING YEAR: Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions & Extensions	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase over Previous Year
1946	.....	.....	.....	129,262	3.163,219	.....
1947	192,237	59,301	251,538	160,782	3,253,975	90,756
1948	405,874	64,683	470,557	183,749	3,540,783	286,808

Fig. 1. Basementless house.

Radiant Baseboa-

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DURING the past year the University of Illinois, in cooperation with the Institute of Boiler and Radiator Manufacturers, investigated the performance of a radiant baseboard heating system in a basementless home. This supplements previous work done on radiant baseboard in the I=B=R Research Home.[1,2]

The object of the tests discussed in this paper was to determine the operating characteristics of a hot-water heating system using type RC, cast-iron, radiant baseboards in a basementless home. These characteristics included the temperature of the floor slab, the temperature gradients in the rooms, the operating temperatures in the hot-water system, fuel consumption, relative humidity, and cleanliness of operation.

Description of Equipment

House: The basementless home, shown in *Fig. 1*, was of prefabricated construction. The walls were composed of 3/8-in. fiber wall board on the room side, 2-in. by 3-in. wood framing members, and 3/8-in. plywood on the outside. One inch of cotton insulation, provided with a vapor barrier, was applied to the wall board between the framing members. The calculated coefficient of heat transmission, *U*, for this wall section was 0.16 Btu/sq ft/hr/deg F temperature difference. The ceiling was composed of 1/4-in. plywood, 2 in. of cotton insulation, and 2-in. by 4-in. joints. The *U* value was 0.13 Btu/sq ft/hr/deg F temperature difference. The house was erected on a 4-in. concrete floor and to minimize the heat losses at the edge of the slab, 1-in. waterproof board insulation was installed around the periphery and between the slab and foundation. A vapor barrier was placed between the slab and gravel fill to prevent vapor transmission. Calculated heat losses through the floor were based on a factor of 0.06 Btu/sq ft/hr/deg F and a temperature difference from room air to ground of 20° F.

All windows and doors were weatherstripped, and storm doors were used on both outside entrances. The total heat loss, based on —10° outdoor temperature, and 70° F indoor temperature, was 42,750 Btu/hr. The total floor area of the heated space was 713 sq ft and the volume was 5702 cu ft. *Table 1* gives a summary of the calculated heat loss, the volume, and the installed radiation in each room in the house. A floor plan of the house is shown in *Fig. 2*, and construction details of floor and walls are shown in *Figs. 3 and 4.*

Heating System: A gas conversion burner was used in conjunction with a wet-base type cast-iron boiler composed of two 6-in. sections and one 4-in. section, surrounded on top, sides and back with a 1-in. thickness of air-cell insulation and completely enclosed in an enamelled sheet-metal jacket. All cracks between sections were sealed with asbestos cement. The net I=B=R rating was 55,000 Btu/hr.

A one-pipe, forced-circulation, hot-water system was used with type RC, cast-iron radiant baseboards. These units, approximately 7 in. high, were located in the rooms as shown in *Fig. 2.* Paper-backed aluminum foil served as a dust seal to prevent the possibility of streaking the wall. The radiation in the living room and kitchen were connected in series and comprised one circuit, the two bedroom radiators were connected in series to form a second circuit, and the bath a third circuit. Furthermore, the piping was so arranged that the radiation in the bath could also be connected in series with the radiation in the two bedrooms and thus divide the system into only two circuits. The system was designed to operate with a mean water temperature of 215° F at 80° indoor-outdoor temperature difference, and a 20° drop through each circuit.

Three-quarter inch wrought-steel pipe was used almost entirely in the piping layout. In order that the system could be drained, the supply and return pipes in the concrete slab (see *Fig. 2)* were pitched downward to the sump in the utility room where drain valves were provided. Three-quarter inch air-cell insulation was placed around the pipe buried in the concrete. The insulation permitted sufficient movement of the pipe to provide for expansion in the system due to temperature changes and also it made it easier to connect the radiation to the supply and return piping at the time of installation. Each baseboard assembly was provided with an air vent to eliminate any air that might accumulate in the radiation or piping. The

[3]A Study of Radiant Baseboard Heating in the I=B=R Research Home. (University of Illinois, *Engineering Experiment Station, Bulletin* 358, p. 22.)

[4]Performance of a Hot-Water Heating System in the I=B=R Research Home at the University of Illinois, (University of Illinois, *Engineering Experiment Station, Bulletin* 349, Fig. 27.)

oa- In a Basementless House

Authors Harris and Weigel have been conducting an investigation of a radiant baseboard heating system in a basementless house during the past year. Their determination of the system's operating characteristics is discussed herein.

amount of radiation, together with the size and amount of pipe and fittings, are given in *Table 2*.

Control System: The control system, shown in *Fig. 5*, included a room thermostat, a high-limit control, a magnetic gas valve, a safety pilot, a transformer, and a relay. The room thermostat was of the heat-anticipating type, and in addition, contained provision for making three adjustments of the length of the burner and circulator operating cycle for a given outdoor temperature. The thermostat was located 30 in. above the floor on the east wall of the living room near the hall entrance (see *Fig. 2*). The high-limit control, which served to prevent overheating of the water in the boiler, was of the immersion type and was located in the back section of the boiler.

When heat was required, the gas burner and circulator were started by the thermostat and both continued to operate until stopped by the room thermostat. If the period of operation was of sufficient duration to raise the temperature of the water in the boiler to 220° F, corresponding to the setting of the high-limit control, the latter would stop the burner. The circulator, however, would continue to operate. This system of control was used since domestic hot water was not being provided by the boiler.

Testing Apparatus: While the house was being erected, copper-constantan thermocouples were located in the living room and kitchen floor slabs as shown in *Figs. 3 and 4*, respectively. It may be noted that slab temperatures in the living room were measured in a plane perpendicular to the west wall and that baseboard radiation extended not less than 7 ft-6 in. on either side of the plane in which the thermocouples were located. Therefore, the temperatures measured in this plane were fairly representative of slab temperatures that existed in any plane perpendicular to a wall at a point where baseboard radiation was located.

With one exception, the thermocouples in the kitchen floor slab were located in a plane perpendicular to the north wall and at a distance of 4 ft-10 in. from the baseboard radiation on the north wall of the living room and 4 ft-9 in. from the nearest radiation in the kitchen. Since the closest radiant baseboard was 4 ft-9 in. away from the plane of the thermocouple location, the temperatures measured by the thermocouples, shown in *Fig. 4*, were probably representative of slab temperatures that would have been obtained had no baseboard radiation been used.

A group of eight thermocouples was provided for the measurement of air temperatures at various levels in any room of the house. Four of these thermocouples were attached to a portable standard at levels of 3 in., 30 in., and 60 in. above the floor, and 3 in. below the ceiling. The other four thermocouples were similarly attached to a second standard. The lead wires to the thermocouples were of sufficient length to permit locating the standards in any room. The use of portable standards gave maximum flexibility in measuring air temperatures, and when not in use, they could easily be stored in the utility room. A third group of thermocouples was provided to study performance of the component parts of the heating system, including the temperature of the water entering and leaving each circuit, and the temperature of the water entering and leaving the boiler. A chromel-alumel thermocouple made of No. 22 B & S gauge wire was located at the smoke outlet of the boiler.

TABLE 1.—DATA ON BASEMENTLESS HOME AND HEATING SYSTEM

				Installed Radiation Low Height Type RC	
Room	*Dimensions*	*Heated Space Cu Ft*	*Calculated Heat Loss Btu per Hr*	*Lineal Ft of Radiant Baseboard*[a]	*Radiation Installed Sq Ft*[b]
Utility Room	8 ft- 0 in. x 11 ft-10 in.	755	5928	—	—
Kitchen	9 ft- 3 in. x 11 ft-10 in.	784	6384	10	20.8
Living Room	11 ft-10 in. x 19 ft-10 in.	1869	13680	26	54.1
Front Bedroom	9 ft-11 in. x 11 ft-10 in.	935	7182	15	31.2
Rear Bedroom	8 ft- 9 in. x 11 ft-10 in.	831	6612	14	29.2
Bath	5 ft- 0 in. x 8 ft- 1 in.	324	2394	5	10.4
Hall	7 ft- 1 in. x 3 ft- 7 in.	204	570	—	—
	Total	5702	42750		145.7

Net I=B=R Boiler Rating = 55,000 Btu/hour Gas Burning Rate = 100 cu ft/hour

a Based on a heat emission of 500 Btu per lineal ft at an average water temperature of 215°F.

b Based on a heat emission of 240 Btu/hour/sq ft at 215°F.

Central Switchboard

A central switchboard was located in the utility room and all of the thermocouple leads were connected to jacks on this board. Each hot junction was provided with an individual cold junction which was maintained at 32° F by means of an ice bath. All cold junctions were insulated electrically by wrapping with thread and coating with ambroid. A portable precision potentiometer and a 10-point recording potentiometer provided means for either instantaneous readings of the emf of each thermocouple or continuous printed records of the emf given by any copper-constantan thermocouple. The range of the 10-point recording potentiometer, however, was from —1 to +5 mv which did not permit record-

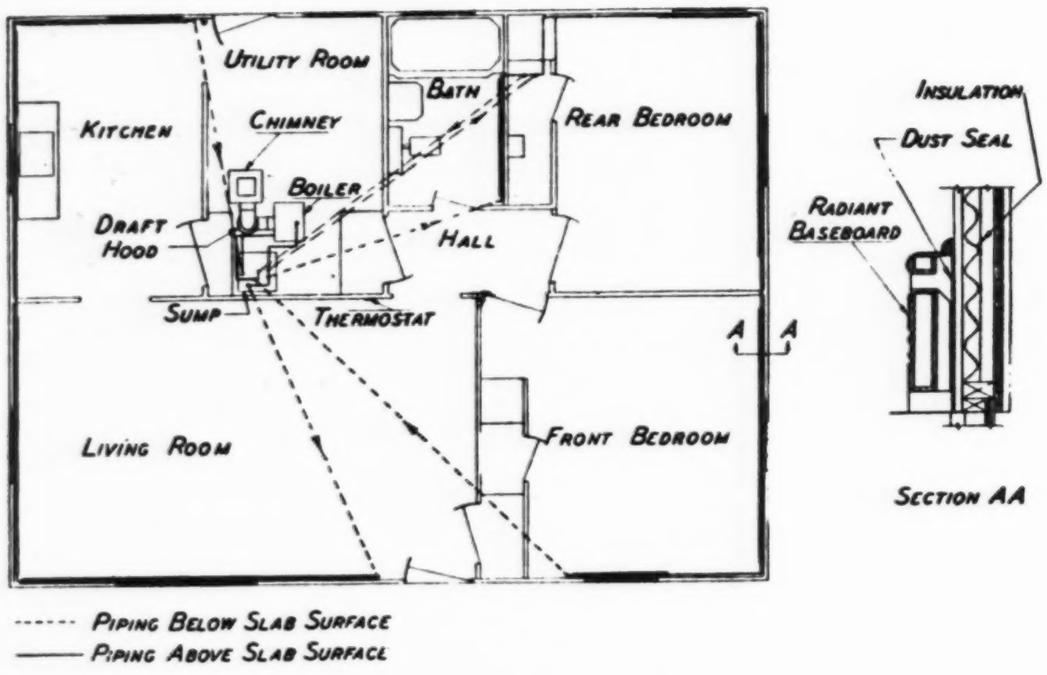


Fig. 2. Flcor plan showing location of baseboard radiation.

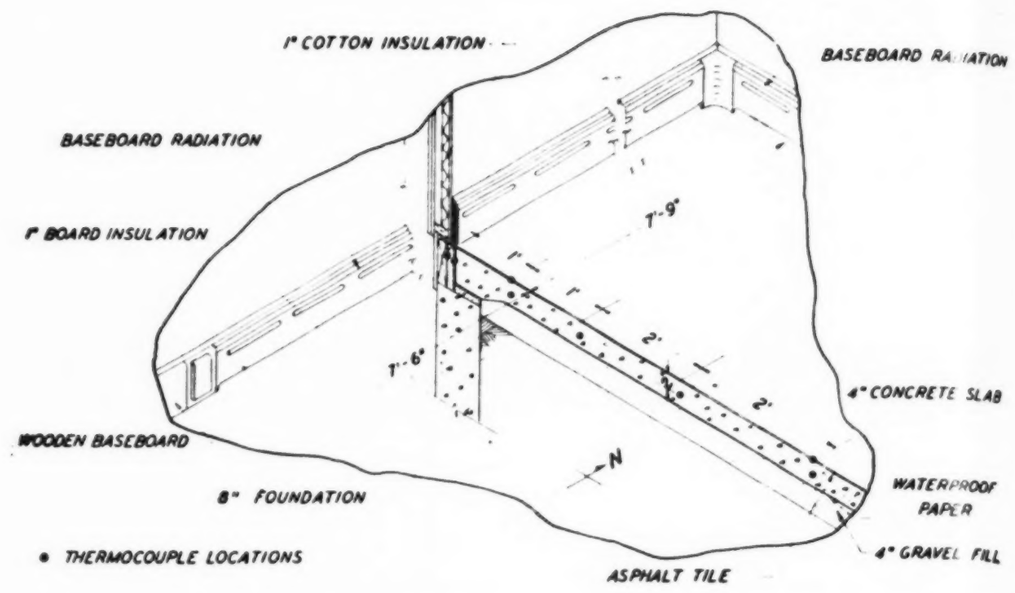


Fig. 3. Thermocouple locations in living room slab.

ing of the flue gas temperatures.

A recording hygrometer was used to make continuous records of the air temperature and relative humidity at the 30-in. level in the living room. This instrument was checked periodically with an aspiration type psychrometer. The CO_2 content of the flue gases was checked periodically with an Orsat apparatus. Self-starting electric clocks were connected in parallel with the gas valve and the circulator motor and recorded the total time of the operation of each unit during the test period. A gas meter was used to measure the quantity of gas used.

Test Procedure

A gas burning rate of approximately 100 cfh was maintained during burner operating periods throughout the entire heating season. Burner adjustment was such that a CO_2 content of from 7 to 8.5% was obtained at the smoke outlet of the boiler. The natural gas used was supplied from the Texas-Oklahoma pipeline, and had a gross heating value of 1000 Btu/cu ft.

Since the house was occupied by a family consisting of a man, his wife, and one small child, cooking, washing and other domestic processes were carried on in a normal manner. Little attempt was made to control door positions between rooms. Although the occupants of the house generally kept the door between the kitchen and utility room closed, room air temperatures were not taken until the investigator assured himself that this door had been closed a minimum of 30 min prior to taking observations. Windows remained closed at all times. Observations of room air temperatures at 3 in., 30 in., and 60 in. above the floor, and 3 in. below the ceiling, were made at periodic intervals. Approximately every 48 hours, the operating time of the burner and the circulator, cubic feet of gas consumed by the burner, and floor slab temperatures were recorded. Periodic checks were made of flue gas temperature and CO_2. A continuous recording was made of the outdoor air temperature, the temperature of the water at the supply and return connections of the boiler and at the supply and return of each circuit. The relative humidity and air temperature at the 30-in. level in the living room were also recorded continuously.

During the main series of tests conducted during the 1947-48 heating season, the radiation in the bath was connected in series with the radiation in the two bedrooms, to form one circuit of a one-pipe, forced-circulation hot-water system, while the radiation in the living room was connected in series with that in the kitchen to form a second circuit. A few tests were run, during which the radiation in the bath was connected to a separate circuit, thus permitting the turning off of radiation in the bedrooms at night. This series was abandoned, however, when tests in the I=B=R Research Home indicated that no fuel savings would result from this practice.

In all the tests the thermostat was set to maintain an air temperature of 72° F at the 30-in. level in the living room both day and night.

Results

Slab Temperatures: Fig. 6 shows the variation in surface temperatures of the floor slab over a range of indoor-outdoor temperature differences. The upper curve shows that essentially no difference existed between the average surface temperatures at the approximate centers of the living room and

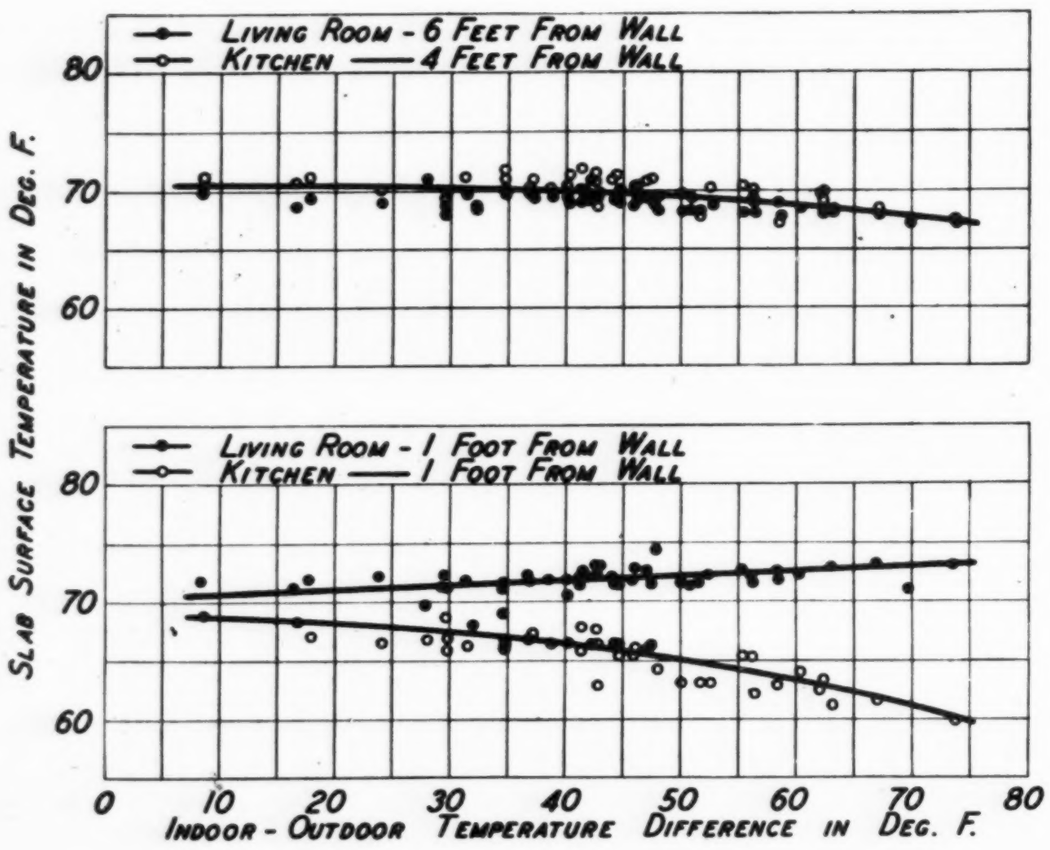
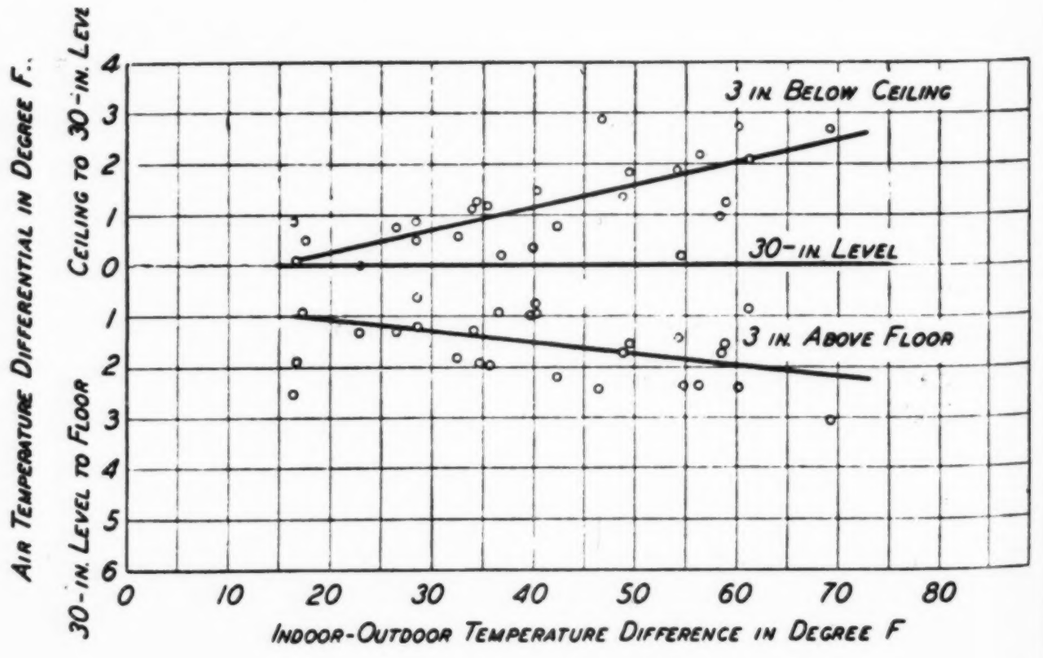


Fig. 6. (left) Surface temperatures of floor slabs.

Fig. 7. (below) Air temperature differentials in living room.



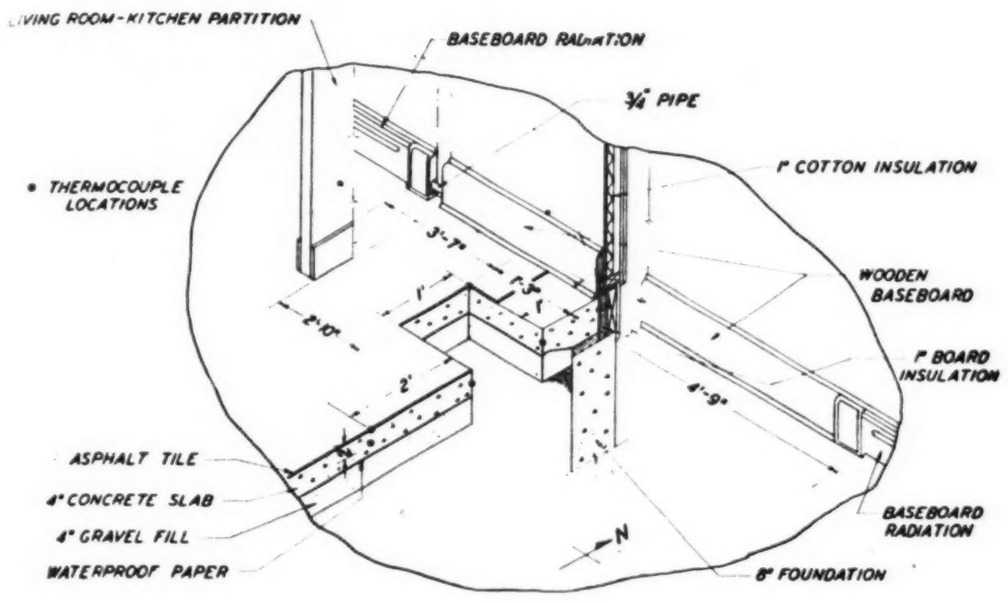


Fig. 4. Thermocouple locations in kitchen floor slab.

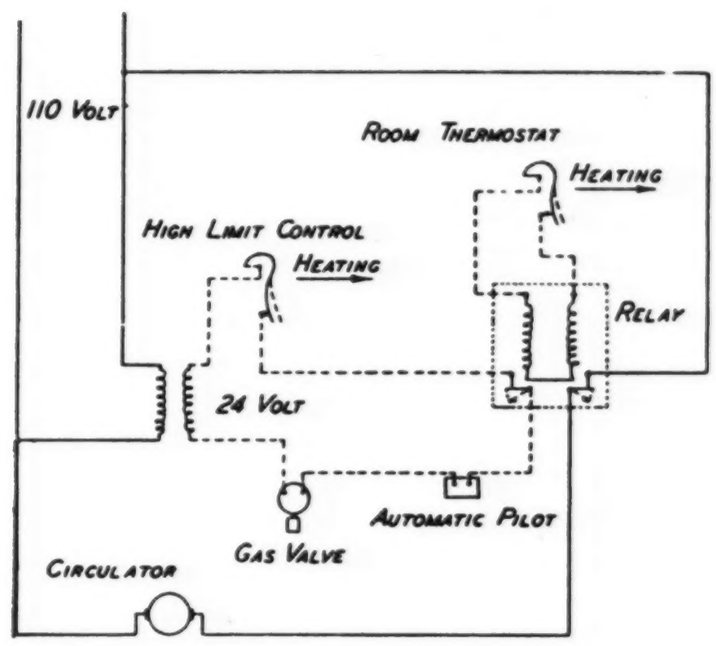


Fig. 5. Control system.

kitchen. Further examination of this curve shows that average surface temperatures at the center of the kitchen and the living room remained practically constant at 70.5° F over the range of indoor-outdoor temperature differences from 0 to 40°. For indoor-outdoor differences greater than 40°, the average surface temperature decreased approximately 1.0° for each 10° increase in indoor-outdoor temperature difference. Thus, at the design condition of 80° indoor-outdoor temperature difference, the average surface temperature in the center of the room would be about 66.5° F.

The lower curves in *Fig. 6* show that slab surface temperatures, 1 ft from the west wall in the living room and 1 ft from the north wall in the kitchen, were markedly different. As a result of higher water temperatures in the heating system in the colder weather, the floor surface temperature in the living room increased slightly as the indoor-outdoor temperature difference increased. The average surface temperatures in the living room were 70.5° F and 73.0° F for indoor-outdoor temperature differences of 10° and 70°, respectively. In the kitchen, floor temperatures measured 1 ft from the north wall were influenced primarily by outdoor and indoor air temperatures. Hence, as the indoor-outdoor temperature differences increased, the surface temperature decreased. Average surface temperatures of 68.8° and 61.0° were obtained 1 ft from the wall in the kitchen at indoor-outdoor temperature differences of 10° and 70°, respectively.

An analysis of the data on the study of floor slab temperatures shows that the radiant baseboard is particularly adapted to maintaining comfortable floor temperatures in a basementless type of structure. Surface temperatures in the center of the room were always comfortable and wherever radiant baseboard was installed, temperatures near the edge of the slab were slightly higher than in the center of the room. However, where no radiant baseboard was installed, floor temperatures near outside walls were considerably lower; hence, the advantage of radiant baseboard lies in the large amount of outside wall exposure that a long, low unit of this type covers.

Room Air Temperature: In *Fig. 7* the differences between the average temperatures of the air in the center of the living room, as measured at the 30-in. level, and at 3 in. above the floor, and 3 in. below the ceiling, are shown plotted against indoor-outdoor temperature differences. The scattered pattern of the points is attributed in part to the limitations in obtaining these temperatures with the house occupied. In order not to inconvenience the occupants, the portable standard was set up each time a set of temperature measurements was to be taken. The readings were generally recorded for a duration of 30 min and without regard to burner and circulator operation.

Fig. 7 shows that, in the basementless house, the temperature difference from floor to ceiling increased with indoor-outdoor temperature difference. At 69.5° indoor-outdoor temperature difference, the coldest weather at which these temperatures were measured, a difference of only 4.6° was observed between the average temperature of the air 3 in. above the floor and 3 in. below the ceiling. For all practical purposes this was about the same as that obtained with type RC radiant baseboard in the I=B=R Research Home.[3] The Research Home had a full basement.

Average air temperatures in the center of the living room of the basementless home, as measured 3 in. above the floor, were aprpoximately 70° to 71° F for all indoor-outdoor temperature differences encountered. In the occupancy

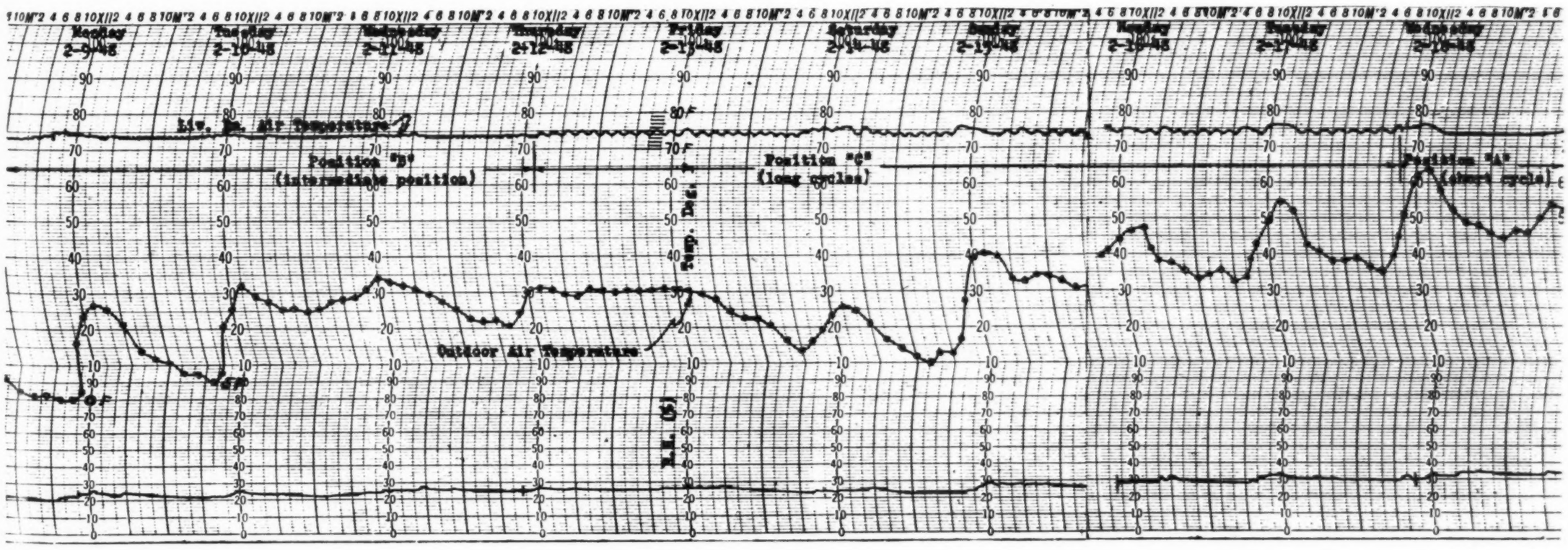


Fig. 8. Air temperature at the 30-in. level in the living room.

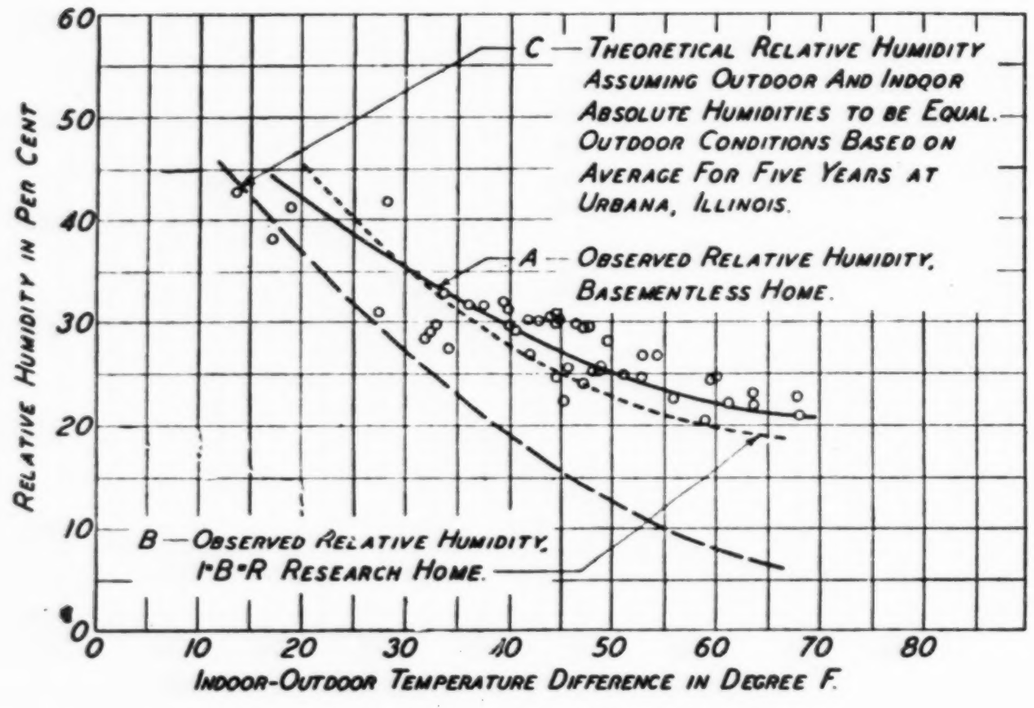
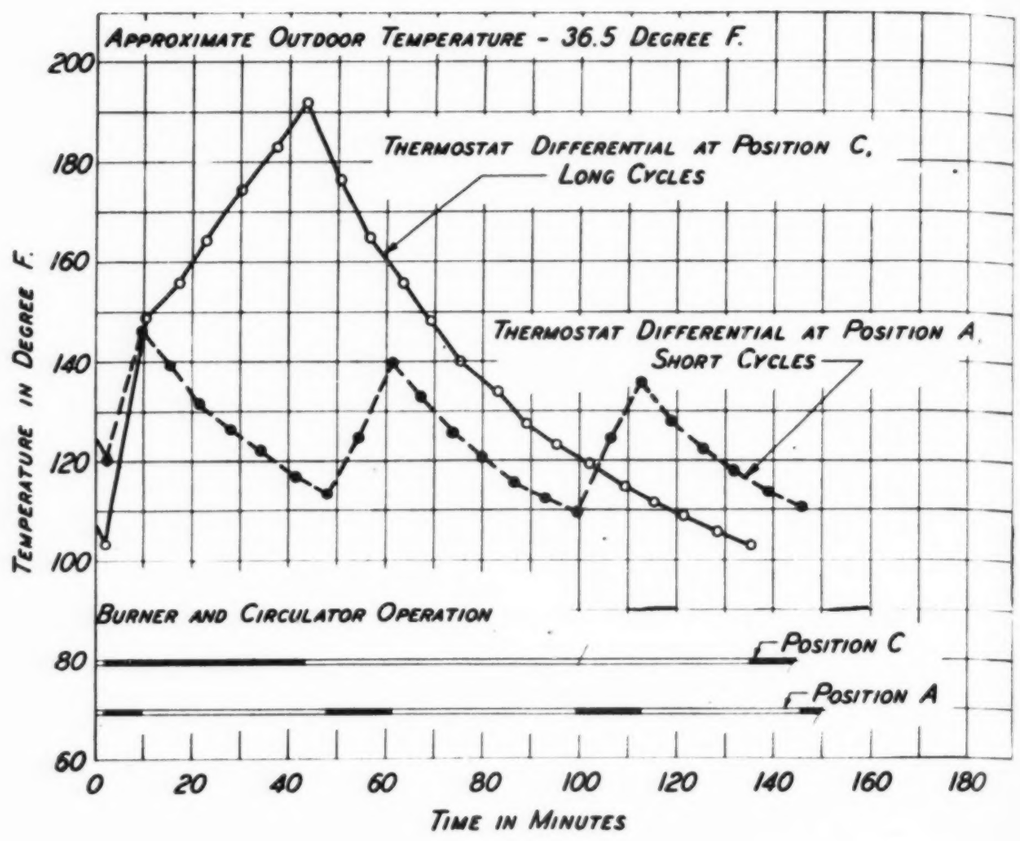

C — Theoretical Relative Humidity Assuming Outdoor And Indoor Absolute Humidities to be Equal. Outdoor Conditions Based on Average For Five Years at Urbana, Illinois.
A — Observed Relative Humidity, Basementless Home.
B — Observed Relative Humidity, I-B-R Research Home.
Relative Humidity in Per Cent
Indoor-Outdoor Temperature Difference in Degree F.

Fig. 9. Indoor relative humidity.


Approximate Outdoor Temperature - 36.5 Degree F.
Thermostat Differential at Position C, Long Cycles
Thermostat Differential at Position A, Short Cycles
Temperature in Degree F.
Burner and Circulator Operation
Position C
Position A
Time in Minutes

zone, 30-in. level to floor, temperature differences were only 1.0° to 2.0°. These results together with results previously obtained in the I=B=R Research Home[3] indicate that the radiant baseboard, if properly installed, will maintain excellent air temperatures in homes built with basements or in those built on concrete slabs in direct contact with the ground.

Fig. 8 is a reproduction of a seven-day recorder chart taken from an instrument located adjacent to the thermostat in the living room. During the course of the seven days that this chart was being made, three different settings of the thermostat differential were used. The chart illustrates clearly that the maximum and minimum air temperatures were affected by the length of the *on* and *off* periods of the burner and circulator. Long cycles of burner and circulator operation, obtained by setting the adjustable differential on the thermostat to position *C*, resulted in cyclic air temperature variations between *on* and *off* period of approximately 1.5°.

Intermediate cycle length obtained with the position of *B* setting, gave a variation of about 1°, and short cycles, obtained with the position of *A* setting, gave practically no variation in the living room air temperature at the 30-in. level. Air temperature variations near the ceiling were slightly greater than those just referred to. Furthermore, the temperature variations in the living room were more pronounced than in the other rooms. Without the aid of thermometers, the occupants of the house could not detect cyclic air temperature variations of 1.5°.

Fig. 8 also shows that, aside from the variations in air temperature discussed in the preceding paragraph, the outdoor temperature had no effect on the indoor air temperature at the thermostat level. The indoor air temperature remained constant even though there was a large and sometimes rapid change in the outdoor temperature. Thus, it is demonstrated that a hot-water system using radiant baseboard can take care of sudden changes in load with little difficulty.

The air temperatures at the 30-in. level in the living room were approximately 1.5 to 2.0° higher than those in all other rooms, except the bath. However, the radiation requirement for the bathroom was based on an 85° indoor-outdoor temperature difference instead of the 80° temperature difference used for the other rooms. Air temperatures in the middle of any room, as measured at the 60-in. level, were approximately 0.5° higher than the temperatures measured at the 30-in. level.

Humidity: Humidity observations were made in the basementless home during the 1947-48 heating season even though no attempt was made to increase the indoor relative humidity by means of a humidifier. Curve *A* in *Fig. 9* shows the relative humidity observed at the 30-in. level in the living room of the basementless home; curve *C*, the relative humidity which would have existed in the house if the absolute humidity indoors had been the

TABLE 2. RADIATION, PIPE, AND FITTINGS USED IN HEATING SYSTEM WITH RADIATION CONNECTED IN TWO CIRCUITS

	Installed Radiation	Pipe		Elbows		Tees		Unions		Specialties	
	Low Height Type RC Baseboard Radiation Lineal ft	*Size, in.*	*Length, ft*	*Size, in.*	*No.*	*Size, in.*	*No.*	*Size, in.*	*No.*	*Unit*	*No.*
Bath-Bedroom Circuit	34	¾	54.0	¾ ¾*	10 4	¾	1	¾	2	¾-in.‡	2
Liv. Rm.-Kitchen Circuit	36	¾	36.2	¾ ¾*	8 4						
Supply Trunk	½ ¾	2.9[a] 14.3[b]	½ ¾	3 2	¾x½x ¾	1 1	½ ¾	1 2	¾-in.§	1
Return Trunk	1	0.5	1	1	¾x1x ¾ 1x1x½	1 1	1	2	1-in.‡	1

*—union; §relief valve; ‡circulator.

	Pipe Totals		*Elbow Totals*		*Tee Totals*		*Union Totals*	
a To expansion tank	½ in.	2.9 ft	½ in.	3	¾ in.	4	½ in.	1
b 6 ft drain from relief valve	¾ in.	104.5 ft	¾ in.	20	¾x½x¾ in.	1	¾ in.	7
	1 in.	0.5 ft.	¾ in. (union)	8	¾x1x¾ in.	1	1 in.	2
			1 in.	1	1x1x½ in.	1		

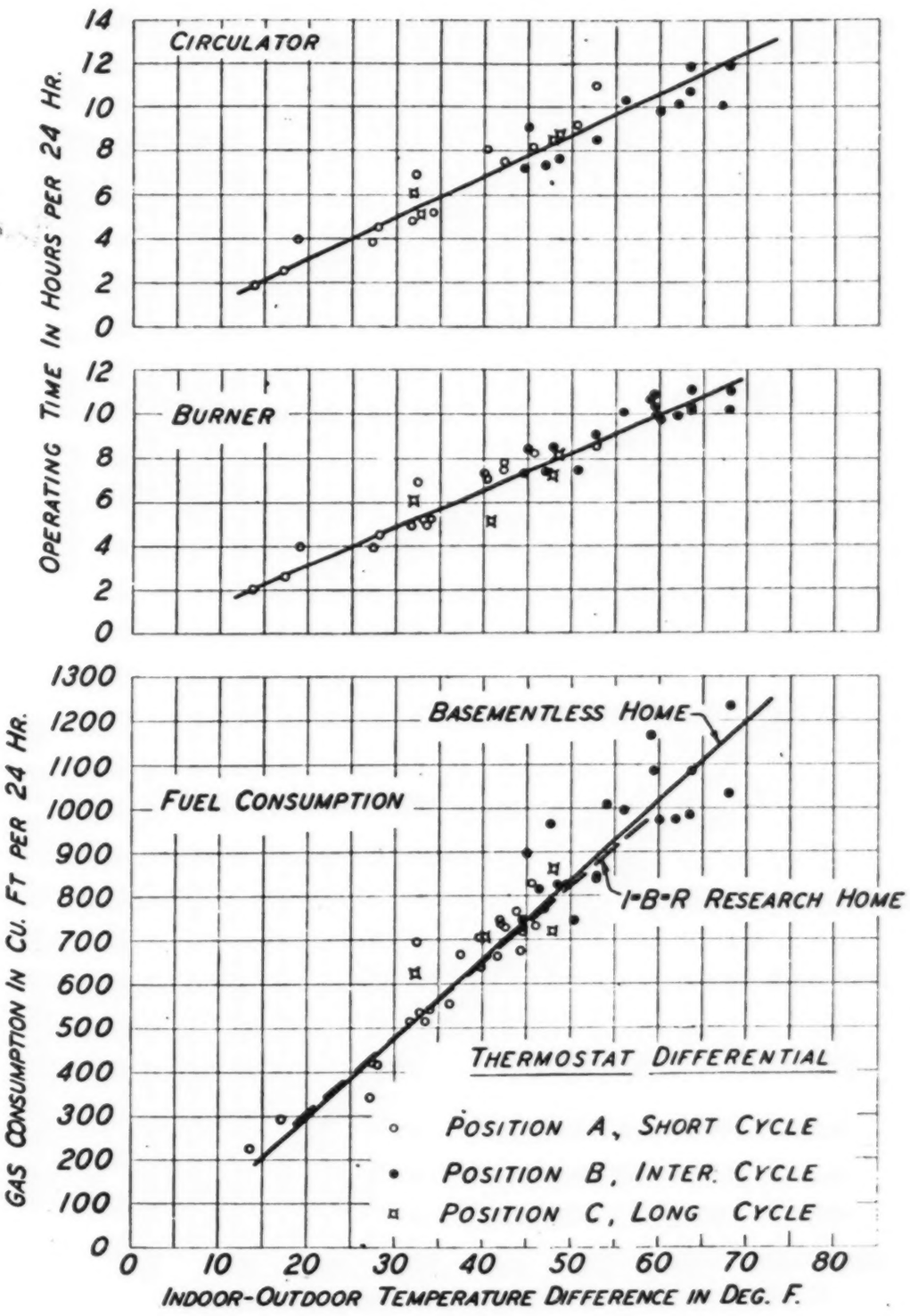
[1]A Study of Radiant Baseboard Heating in the I=B=R Research Home, by Alonzo P. Kratz and Warren S. Harris (University of Illinois, *Engineering Experiment Station, Bulletin 358.*)

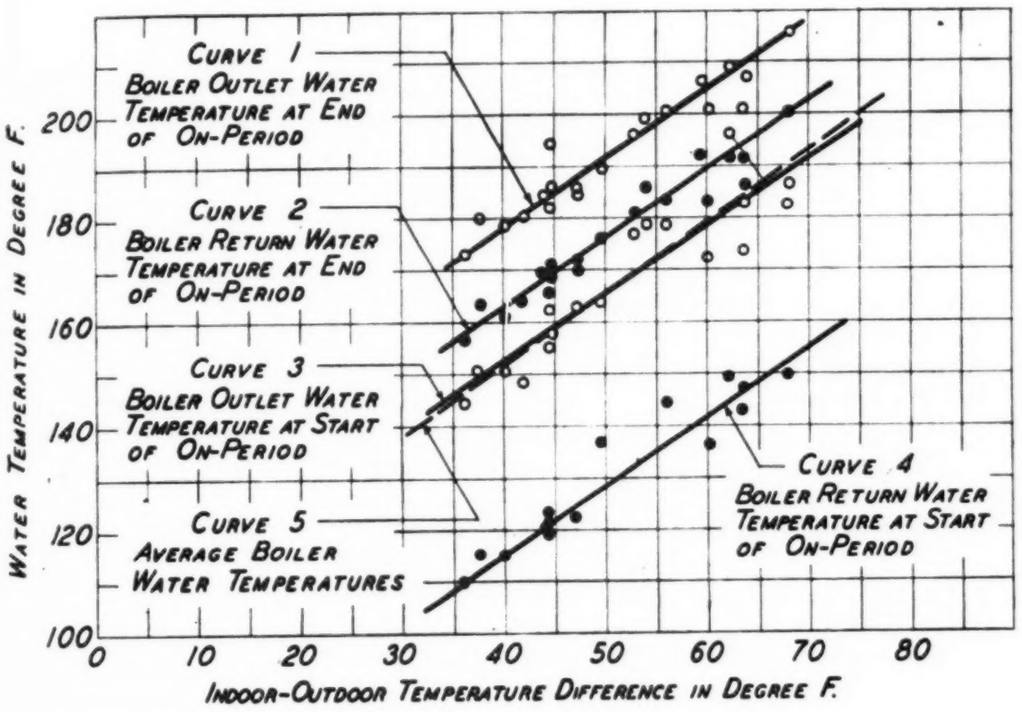
[2]Performance of Radiant Baseboard in Research Home, by A. P. Kratz and W. S. Harris. *(Heating, Piping and Air Conditioning,* Vol. 18, No. 1, Jan. 1946, p. 138.)

Fig. 10. (at left) Boiler inlet water temperatures, two positions of thermostat differential adjustment.

Fig. 11. (below) Boiler water temperatures.

Fig. 12 (at right) Burner and circulator performance.





same as that outdoors; and curve *B*, the relative humidity observed in the I=B=R Research Home[4] with no special means of providing humidification. Each test point represents the average relative humidity for a 48-hr period. The difference between curves *A* and *C* can be considered as representing the moisture added to the indoor air by cooking, by washing, by the occupants, by evaporation from building materials and house furnishings, and by evaporation from water normally used for general purposes in the house, minus that lost to the outside air.

It may be noted that the relative humidities observed in the basementless home and the I=B=R Research Home, as shown by curves *A* and *B*, are in fairly close agreement, yet no cooking or washing was done in the Research Home. Although both houses were insulated and provided with vapor barrier paper in the exposed walls and ceiling, and weatherstripping was applied to the doors and windows, the basementless home was not as tight in construction as the I=B=R Research Home.

In the basementless home the outside doors and the butted joints of the prefabricated wall panels were not tight, and possibilities existed for considerable air leakage and vapor transmission. Thus, it is reasonable to assume that had the basementless home been of tighter construction, higher relative humidities would have been obtained. The problem of maintaining adequate indoor humidites for comfort in winter cannot be separated from consideration of good building construction. If houses are tightly constructed little difficulty is experienced in maintaining an adequate indoor humidity in winter.

TABLE 3—TEMPERATURE DROP THROUGH BOILER AND RADIATOR CIRCUITS WITH SYSTEM OPERATING NEAR DESIGN WATER TEMPERATURE

Circuit	Avg. Inlet Temp F	Avg. Outlet Temp F	Temp Drop F Deg
TWO CIRCUITS			
Boiler	197.8	210.0	—12.2
Bath-Bedroom	209.5	197.7	+11.8
Liv. Rm.-Kitchen	209.3	199.5	+ 9.8
THREE CIRCUITS			
Boiler	196.5	206.5	—10.0
Bath	205.9	202.7	+ 3.2
Liv. Rm.-Kitchen	206.0	194.5	+11.5
Bedroom	206.0	192.5	+13.5

Water Temperatures in Boiler and Radiant Baseboard: As shown in *Fig. 10*, position *A* of the adjustable differential on the thermostat gave shorter *off* and *on* periods, and hence more cycles of burner and circulator operation, for a given indoor-outdoor temperature difference than did position *C*. It may also be noted that boiler inlet water temperatures for position *A*, at 36.5° F outdoor temperature, varied from 110° F to about 140° F, a range of 30°, while water temperatures for position C varied from 102° F to 191° F, or a range of 89°. These ranges of water temperatures at the boiler inlet are fairly indicative of changes in water temperatures in the baseboard radiation. Thus, with the shorter cycles of burner and circulator operation smaller fluctuations occurred in the water temperatures for the radiant baseboard and hence, smaller variations occurred in the indoor air temperatures.

In *Fig. 11*, curves *1* and *2* show the water temperatures obtained at the boiler outlet and return connections at the end of the circulator *on* period, whereas curves *3* and *4* show the water temperatures at the outlet and return connections at the beginning of the circulator *on* period. The arithmetical average of curves *1*, *2*, *3*, and *4* is represented by curve *5*. For all practical

purposes curve 5 represents the average temperature of the water in the boiler for any given indoor-outdoor temperature difference. It is also representative of the average water temperature in the radiant baseboard.

The radiation installed in the basementless home was just sufficient to offset the calculated heat loss at an outdoor temperature of —10° F when the radiant baseboards were supplied with an average water temperature of 215° F. By extrapolation of the boiler water temperature curve 5 in *Fig. 11* it will be found that at an indoor-outdoor temperature difference of 80°, the average boiler water temperature was 205.5° F, and the average water temperature in the radiant baseboards, which was essentially the same as the average boiler water temperature, would have been about 9.5° lower than that selected for the design of the system. Thus, the amount of radiation installed was sufficient to carry the load at design conditions with only a small reserve capacity available.

Table 3 shows the temperature drop through the boiler and radiator circuits with both a two-circuit and a three-circuit flow. In the two-circuit system the bath was included in the bedroom circuit, and in the three-circuit system the bathroom radiation was in a circuit by itself. It may be noted that the maximum temperature drop that occurred in any circuit was 13.5° F. Since the heating system was designed on a 20° temperature drop, it is evident that the flow of water in each circuit was more than ample to take care of the radiation connected to the circuit.

Fuel Consumption: Fig. 12 shows daily burner and circulator operating time and fuel consumption for operation at three settings of the thermostat differential. While changes in the thermostat differential had a marked effect on the length and number of operating cycles for any given indoor-outdoor temperature difference *(Fig. 10)*, it may be observed in *Fig. 12* that the setting of the thermostat differential adjustment had no appreciable effect on the total daily operating time of the burner or circulator or on the daily fuel consumption.

By extrapolation of the curve for burner operating time, shown in *Fig. 12*, a total operating time of only 13.5 hrs per day would be obtained at an indoor-outdoor temperature difference of 80°, thus indicating that the burner and boiler had ample reserve capacity.

Since the calculated heat losses of the Research Home and the basementless house were in close agreement, the fuel consumption obtained in the Research Home, when using radiant baseboard, has been included in *Fig. 12* and, as might be expected, the daily fuel consumption for the two houses was also in close agreement at all indoor-outdoor temperature differences.

Cleanliness of Operation: The basementless home was ready for occupancy in May 1947, and when heat was applied, all the walls were freshly painted and all the curtains and draperies were clean and new. After operating through a complete heating season of approximately nine months, faint dirt patterns were observed on some of the walls above the radiant baseboard. Curtains and draperies that hung over the radiant baseboard, however, were as clean as similar curtains and draperies under which no radiant baseboard was located.

Dirt patterns are the result of dust being carried close to the walls by convection currents and being deposited by thermal precipitation. Experience in the I=B=R Research Home and elsewhere, has indicated that dirt patterns may be eliminated by reducing the design water temperature in the radiant baseboard to 200° F or lower. This decreases the convection currents set up by the radiant baseboard and, hence, reduces the magnitude of the temperature gradient near the wall.

Summary and Conclusions

A summary of the test results of this investigation and the conclusions that may be reached are as follows:

1. The radiant baseboard is particularly adapted to maintaining comfortable floor slab temperatures in a basementless structure, as long, low units of this type cover a large percentage of outside exposure.

2. Average air temperatures, as measured 3 in. above the floor, were approximately 70 to 71° for all indoor-outdoor temperature differences encountered when the temperature at the 30-in. level was 72°F.

3. Temperature differences between the occupancy zone, as measured 3 in. and 30 in. above the floor, were only of the magnitudes of 1.5 to 2°.

4. The hot-water heating system using radiant baseboard responded quickly to sudden changes in load, thus maintaining constant room air temperature even while the outdoor temperature was changing rapidly.

5. The problem of maintaining adequate indoor humidities for comfort in winter cannot be separated from consideration of good building construction. At 10°F outdoor temperature 22% relative humidity was obtained in the basementless home.

6. Fuel consumption was not affected by setting of the adjustable differential on the thermostat; however, water temperatures in the radiant baseboards, and consequent fluctuations in room air temperatures, were affected. The longer lengths of the *on* and *off* periods of the burner and circulator resulted in greater fluctuations of room air temperatures.

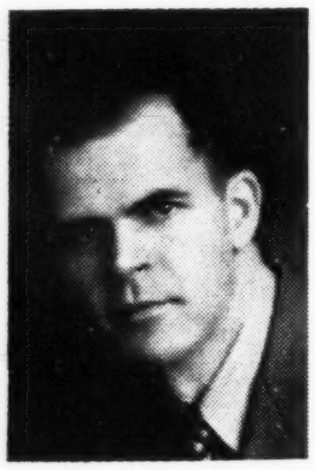
7. Faint dirt patterns were observed on some of the walls above the radiant baseboard after nine months of operation. Dirt patterns of this type can be eliminated by limiting the water temperature to a maximum of 200°F.

Acknowledgments

The results presented in this paper were obtained in connection with the investigation of steam and hot-water heating systems being made in the Department of Mechanical Engineering at the University of Illinois. The investigation is a cooperative project sponsored jointly by the Engineering Experiment Station of the University and the Institute of Boiler and Radiator Manufacturers.

This paper is largely an abstract of a thesis written by Mr. Weigel in partial fulfillment of the requirements for the Degree of Master of Science in Mechanical Engineering in the Graduate College of the University of Illinois. Also, these results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the various manufacturers who cooperated by furnishing materials and equipment.

The Authors



W. S. Harris

R. H. Weigel

W. S. Harris is in charge of the experimental research work at the University of Illinois being done under the terms of the cooperative agreement with the Institute of Boiler and Radiator Manufacturers. He has headed this project since 1940. Both his B.S. and M.S. degrees were received at Illinois, in 1930 and 1933, where, during graduate years, he served as part-time assistant at the Warm Air Research Residence. He has worked in the research laboratory of the Philadelphia & Reading Coal and Iron Co. and the thermal research and development laboratory of the Delco appliance division of General Motors.

Robert H. Weigel is working as special research assistant at the I B R Research Home under Professor Harris' supervision. Receiving his bachelor's degree from the University of Louisville in 1935, he went to work for the Louisville Gas & Electric Co. as assistant to the gas distribution engineer until 1941, when he entered war department work. He matriculated at Illinois' graduate school in 1947.

This paper was written for presentation at the 55th annual meeting of the American Society of Heating & Ventilating Engineers, Chicago, Ill., Jan., 1949.

Mobile Office Speeds ConEd Emergency Service

CONSOLIDATED Edison Co., New York, has added a specially designed emergency field headquarters truck, featuring a complete "office on wheels," to its extensive vehicular fleet.

This new mobile office is housed in a one-ton panel truck with package delivery body. It was ordered by Consolidated Edison's transportation department for use by the service bureau; its equipment was planned by the service bureau and installed at one of the company shops.

Designed to be used in the field on major emergency jobs, where it serves as the reporting point for field forces and for communication with the office, this truck is equipped with a two-way radio system for direct connection with company offices while in transit and on location at the job.

It is also equipped with telephones and electric cables which can be connected quickly to street or building outlets whenever necessary. Actually, the engine-driven generator is fully capable of meeting the requirements of its electric equipment.

"OFFICE ON WHEELS" inside new field headquarters emergency truck built for ConEd. Two-way radio, phones, counter-type desk, swivel seats, heater, fans, and fire extinguisher are standard equipment. Front to rear are Raymond Earle and George Kieffer, superintendent's assistants, and Lloyd McLaughlin, assistant superintendent. Inset photo shows exterior of the vehicle, a one-ton package delivery model.

Room for Six

Carefully designed to serve as a mobile office, the company field headquarters truck provides working space and facilities for as many as six persons at a time. Equipment includes a long counter-type desk, swivel seats, a heater, fans, a fire extinguisher and a bench in addition to the two-way radio system and telephone apparatus. The truck paneling is heat-insulated on top and sides.

It is garaged at ConEdison's 1st avenue service building in Manhattan, a central location from which it can be dispatched quickly to any trouble spot in Consolidated Edison territory.

The service bureau has a general foreman on duty 24 hours a day. The general foreman on duty dispatches the emergency field headquarters truck at his discretion. When the truck is dispatched the New York Telephone Co. is alerted and if so requested sends a serviceman to make the connections. Close liaison such as this with the telephone company assures rapid establishment of maximum communication facilities to link the field forces on the job with company offices.

The effectiveness of the emergency field headquarters truck as well as liaison with the telephone company was demonstrated in a recent double emergency situation. The truck was dispatched to a job on the gas distribution system where it remained until restoration was completed; it then proceeded directly to a job on the electric distribution system. Its facilities were used jointly by both service bureau and outside plant construction department personnel and as a result considerable time was saved.

Quick Change

Providing service connections at the first location so that the phones were in use when orders were received to proceed to the second job, the telephone company disconnected the service and had personnel on hand to establish new connections when the truck arrived at the second location.

Over 30 company vehicles, mostly assigned to the service bureau, are equipped with radio receivers as part of the special mobile emergency system. Four of them, including the new emergency field headquarters truck, are equipped with two-way type radio facilities.

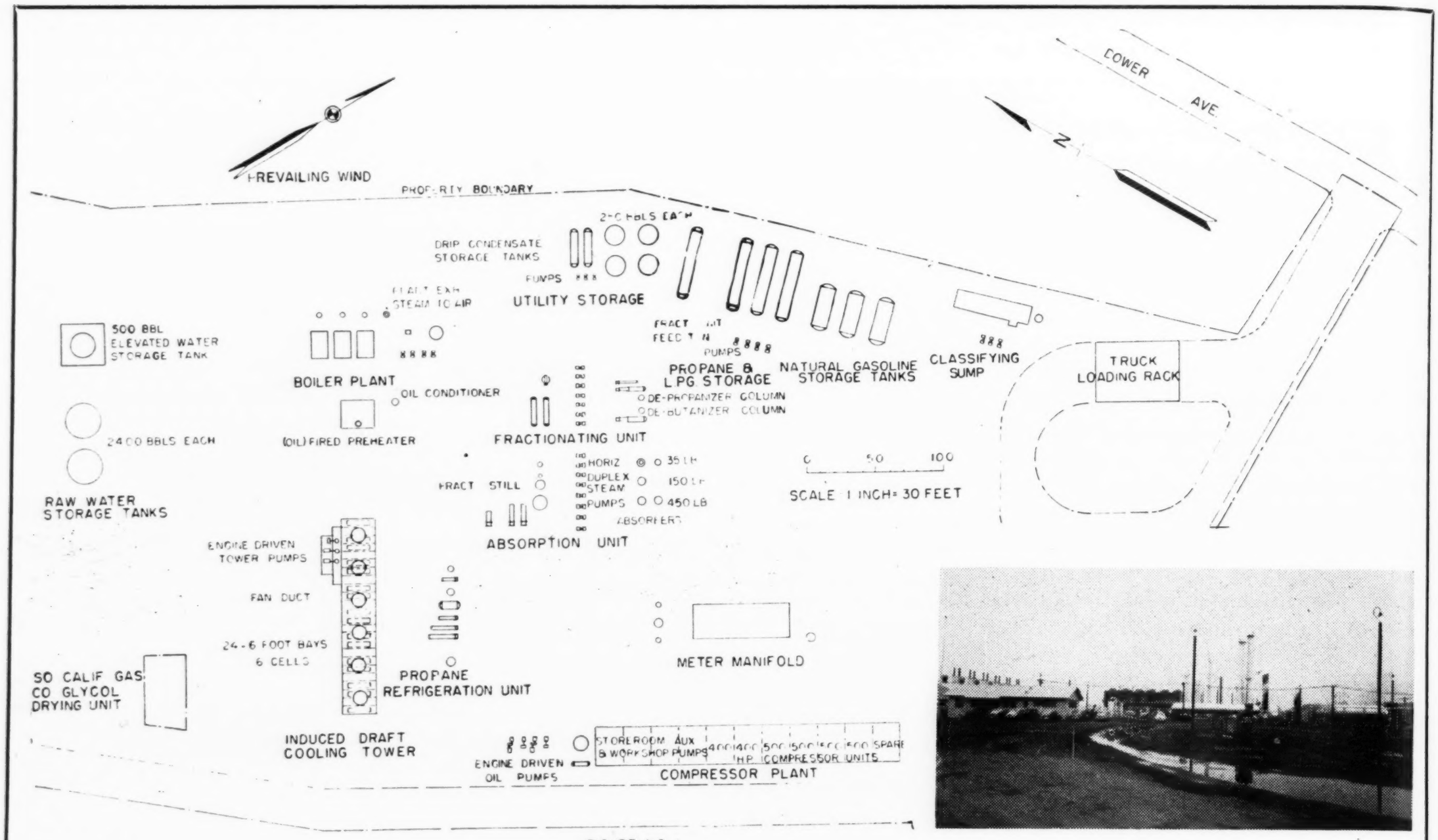


FIGURE NO 1

General Petroleum's Burrel Gasoline Plant

By M. E. GARRISON

A natural gasoline plant which has achieved an 80% extraction level of propane potential and a 90% extraction level of isobutane potential has been operated by the General Petroleum Corp. in the Fresno area of California since April, 1946.

This high extraction efficiency has been particularly desirable since the demand for propane in the area in which the plant is located has been growing at a remarkable rate.

Notable in the design and construction of the plant, which is designated by General Petroleum as the "Burrel Gasoline Plant," is the unique plant gathering system which is believed to be the largest ever installed in a natural gasoline plant in California.

Size and Purpose

The plant was designed with a capacity of 30 MMcf per day of wet gas, which was found to be available in the field at three pressure levels—50 psig, 150 psig, and 450 psig.

Purposes of the plant are: (1) to deliver dry gas at 440 psig to a gas company; (2) to deliver dry gas at from 500 to 600 psig to another gas company pipeline system at a controlled maximum temperature 5° above wet bulb and a minimum temperature of 60° F; (3) to make possible the extraction and retention of 85% of the isobutane content of the wet gas, and at the same time extract up to 70% of the propane content of the wet gas.

The actual extraction in the 35 months the plant has been in operation has exceeded 80% of propane potential and 95% of the isobutane.

A fourth aim of the designers was to make possible selective absorption within the absorption plant to a point where extraction efficiency can be controlled with a minimum quantity of recycled gas and with minimum plant fuel consumption.

To accomplish this, it was calculated that the most economical main absorption pressure would be 450 psig.

ABOVE is a drawing (Fig. 1) of the general layout of the plant, with inset a photo of the yard, looking north. Location of office building shown in photo, in southeast corner of the yard, does not appear on the drawing.

The approximate average isobutane-plus-gasoline content of the combined wet gas was 1.3 gal per thousand cu ft and the 20% rectified content 0.6 gpm.

Field Gathering System

Three areas are available from which the wet gas had to be collected—the Helm field, the Lanare field, and the Riverdale field. The Helm field lies northwest from the gasoline plant, the Lanare field lies south of the gasoline plant, and the Riverdale field lies south and east from the gasoline plant.

From the Helm field a high-pressure wet gas gathering line, approximately eight miles in length, has been laid to the plant, to deliver wet gas at from 440 to 450 psig at the gasoline plant. A low-pressure wet gas line parallels the high-pressure wet gas line to deliver wet gas at the plant at 50 psig. This permits two-stage gas trap opera-

Mr. Garrison is project engineer for the General Petroleum Corp. at Los Angeles.

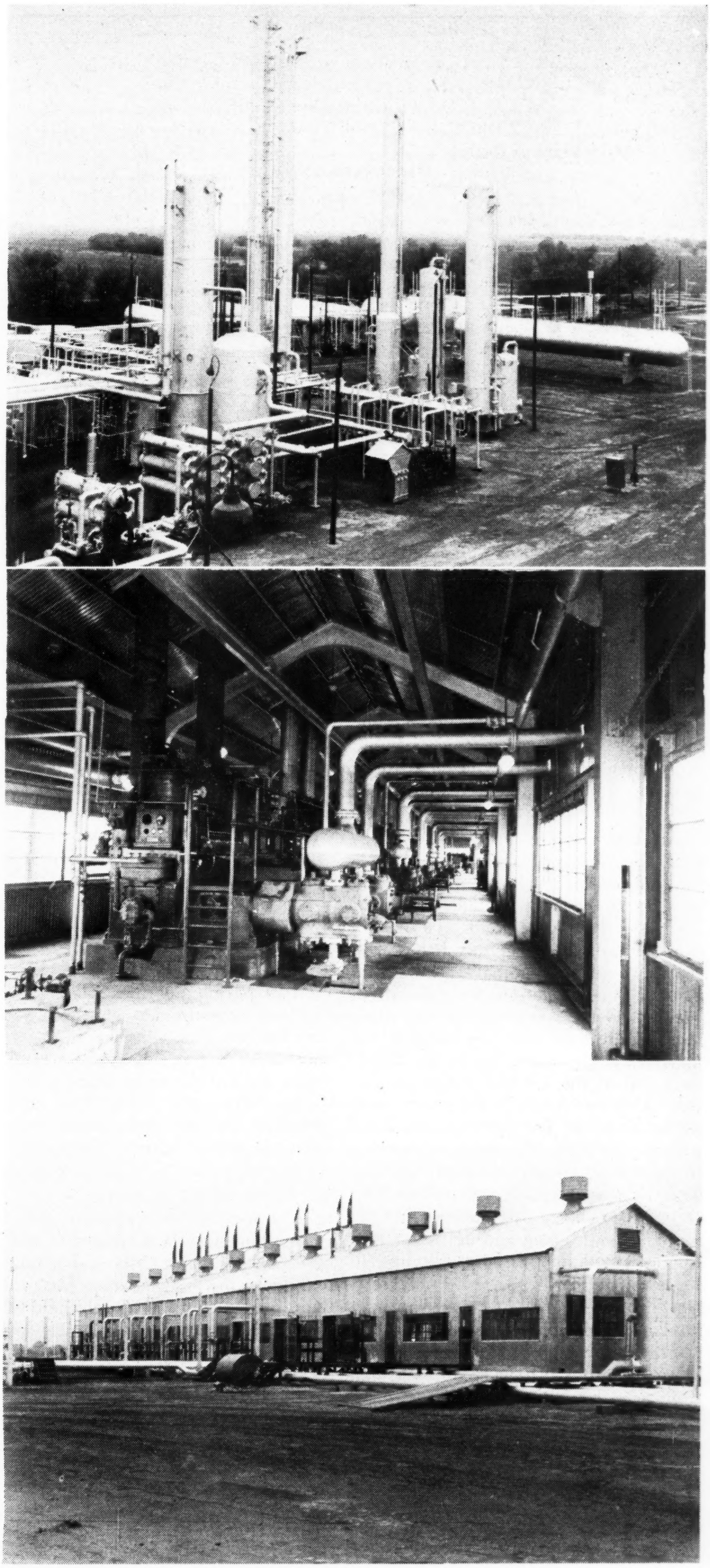
High propane and isobutane extraction efficiency and unique plant gathering system feature 30-MMcf per day installation in central California.

tion for the separation of the oil and gas as it flows from the producing well. In general, all of the wet gas lines are laid to grade sloping toward the gasoline plant. The 50 psig pressure wet gas line carries the condensate for both lines through two sets of drip stations located in the field and one set located at the entrance to the gasoline plant. Vertical drip pots were installed with level and pressure controls, in order to raise the condensate to successively higher elevation.

Line Heaters

On the 450-psi gas line, three heater installations, designed to maintain the gas temperature above 60° F, have been installed to minimize the possibility of the formation of hydrates during the winter months. These installations are of the circulating hot water type and are automatic in operation, requiring very little operating attention. Torrance brand heaters were installed. The element for heating the wet gas consists of a pipe jacket installed around the outside of the main gas line through which hot water from the Torrance heater is circulated by means of a motor driven pump. For the 10-in. line this jacket was installed 80 ft in length, and for the 6-in. line size the jacket was installed 60 ft in length. A flanged expansion joint was installed in the center of each jacket pipe to accommodate for the unequal expansion between the jacket and the main gas line.

A 4-in. dry gas line parallels the Helm wet gas gathering line for approximately 3¼ miles west from the gasoline plant, where it ties to the Amerada Petroleum and to the General Petroleum Corp. dry gas fuel systems. The dry gas pressure on this line is approximately 140 psig.



AT TOP: Stripping, fractionating, absorbing and storage equipment at Burrel plant.

CENTER: Interior of compressor building.

BOTTOM: Exterior of building housing compression and auxiliary equipment.

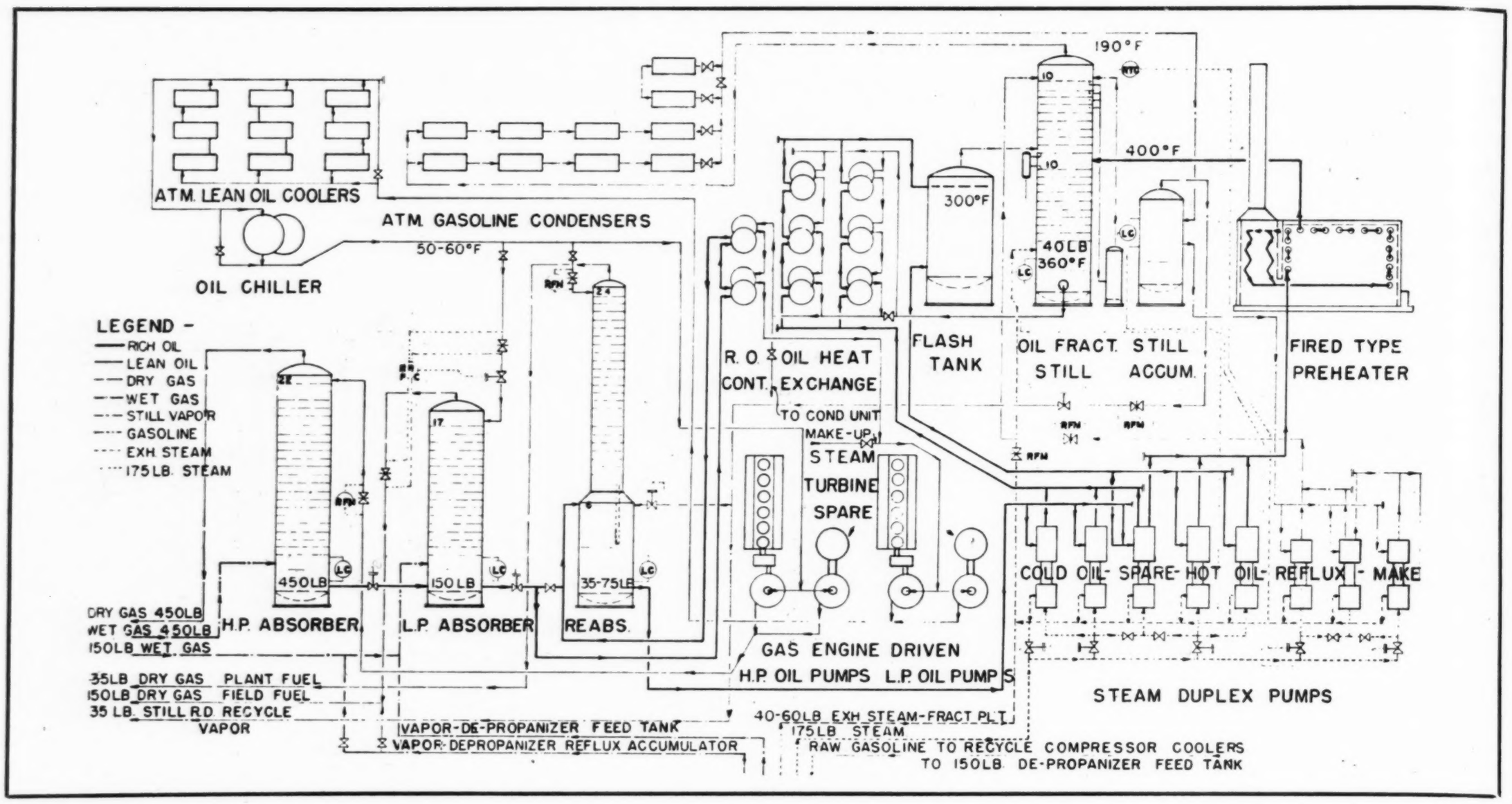


Fig. 2. Absorption unit flow sheet showing general oil and gas flow.

Between the gasoline plant and the Helm field a large irrigation channel, approximately 125 ft wide, had to be crossed. A pipeline suspension bridge was installed over this channel.

An intermediate pressure wet gas gathering line approximately 7½ miles long, to deliver gas at from 145 to 160 psig at the gasoline plant, was laid from the Riverdale field. To collect the low pressure wet gas below 150 psig, two gas engine-driven field compressor booster stations were installed. A low-pressure wet gas gathering pipeline parallels the 150 psig pipeline for approximately 2¾ miles on the Riverdale end of the wet gas collection system. This line delivers wet gas at from 20 to 50 psi to the field booster compressor stations. The suction pressure to these field compressors is regulated so as to not exceed 30 psig. These field compressors boost or compress this gas from 30 to 150 psig and deliver it into the intermediate pressure gas line to the gasoline plant.

Added Compressors

Two additional field compressor stations were later installed. One of these compresses wet gas and tank vapors from 5-in. vacuum to 150 psig; the other compresses tank vapors from 5 to 10-in. vacuum and delivers them into the 30 psig low pressure wet gas line to the aforementioned field booster compressors.

In general, the 150-psig intermediate pressure wet gas line slopes towards the gasoline plant and the low pressure wet gas line slopes towards the field booster compressor stations. Vertical drip pot installations are located at each field compressor station in conjunction with intake wet gas scrubbers. These vertical drip pot installations are also located at the Murphy Slough crossing and at the entrance to the gasoline plant.

Also paralleling the 150-psig intermediate pressure wet gas line, a 4-in. dry gas line was laid. This line, extending from the plant approximately 5 miles toward the east, delivers dry gas to the Riverdale field. The dry gas pressure on this line at the gasoline plant is approximately 140 psig.

The Lanare oil field is located to the south of the gasoline plant. A wet gas collection line approximately 4½ miles long was laid from this field to the gasoline plant. This line originally tied into the intermediate 150-psi wet gas line from the Riverdale field at the plant entrance. Due to pressure decline in this field this line was later connected into the 50-psi wet gas line from the Helm field at the west property boundary of the gasoline plant.

In general, because of the long lengths of pipeline involved in collecting the wet gas, the wet gas gathering system was designed so that when future pressure declines had to be met, field booster compressors would be installed in order to maintain sufficient pressure and capacity.

The field booster compressor units consist of Waukesha 6 Waku 90-hp gas engines which drive type XRB heavy duty Ingersoll-Rand twin cylinder compressor units. The compressor units were second hand. A thermo-syphon oil compressor jacket cooling system with a vertical surge tank was installed for cooling the compressor jackets.

Gasoline Plant Design

From the foregoing it can be noted that there are four gas pressure levels which may be considered for the absorption of the wet gas. At the 600-psi pressure level only two-thirds of the dry gas had to be compressed. From this consideration it can be calculated that the most economical pressure for absorption would be 450 psi. The next consideration is the arrangement or flow necessary to obtain selective absorption for the isobutane and propane content of the wet gas. Furthermore, the dry gas fuel pressure considerations enter into the calculations at this point. A fuel gas pressure of 150 psi was decided to be the most desirable for delivery to the field. On this basis a flow sheet was arranged and the general oil and gas flow for the absorption system is shown in *Fig. 2.*

Propane Refrigeration Unit

Selective absorption is effected partly through the chilling of the wet gas

level regulating valves installed on each vessel named respectively.

Chiller Vessel

In these chiller vessels the propane liquid is evaporated and passes off as a gas through back pressure regulating valves to a common gas line. The back pressure regulating valves are set to control or maintain at from 50 to 70 psi back pressure depending upon the temperature desired. The propane gas after leaving the chillers passes through the heat exchanger to a compressor intake scrubber and to the compressor suction. The discharge gas from the compressor passes to atmospheric coolers in the induced draft cooling tower, where the propane gas is condensed as a liquid at approximately 150 psi totally condensing. The propane liquid and the lean absorption oil. Chilling the lean oil makes possible lower oil circulating rates for a given isobutane absorption factor. Chilling of the dry gas delivered at 500 to 600 psi to the gas company's sales distribution system is necessary during the summer months in order to obtain a 60° F temperature. The formation of hydrates prevents carrying the gas temperature much below 60° while the lean oil temperature may be carried down to 45° to 50° F if so desired.

The flow sheet for the refrigeration unit is shown by *Fig. 3*. From this flow sheet it can be seen that liquid propane from the de-propanizer column is used for filling the accumulator tank after it has been properly cooled. From the accumulator tank the liquid propane passes through a heat exchanger in which the cold propane gas from the chillers in turn cools the propane liquid before expansion. From this exchanger the propane liquid enters the oil chiller, wet gas chiller, and 600-psi dry gas chiller in parallel, being controlled by liquid then flows back to the accumulator tank.

Any lubricating oil usually accumulated in the bottom of the chillers is bled off to the intake scrubber and then bled to the drain system.

It is to be noted that the volume of propane gas handled by the compressor will vary to meet the temperature conditions required. A bypass between the suction and discharge at the compressor station is installed for the operator to open when low gas rates and cold atmospheric temperatures are encountered. This is necessary in order to prevent propane liquid forming on the compressor cylinder walls. If desired this bypass valve could be replaced with a regulator operated by the suction pressure.

Gas Flow Through Plant

The 50-psi wet gas from the Helm field, together with the wet gas from the Lanare field, is piped through a wet gas intake scrubber and composite gas intake meter to the 50-psi pressure compressor suction header. The 50-psi wet gas is compressed to 150 psi and is piped to atmospheric coolers in the induced draft cooling tower and then joins with the 150-psi wet gas from the Riverdale field on the way to the 150-psi wet gas scrubber.

The wet gas is then piped to the compressor suction header and to the 150-psi absorber through a regulating valve controlled by the field fuel gas line pressure. Vent gas from the de-propanizer reflux accumulator and from the de-propanizer feed tank is also connected into the wet gas line to the 150-psi absorber. The vent gas from the de-propanizer reflux accumulator is alternately tied to the field fuel in case a maximum yield of propane is not desired.

The 150-psi pressure wet gas is compressed to 450 psi and is connected to atmospheric coolers in the cooling tower and then to the wet gas chiller, where it is further cooled to 60° F. Leaving the chiller, the 450-psi wet gas joins additional wet gas from the Helm field after the meter manifold. Connections have been left so that the 450-psi wet gas from the field may also be chilled at a later date if desired. The composite 450-psi wet gas is piped to a scrubber for the removal of condensate, and is then piped to the 450-psi absorber.

Gas From Absorber

The dry gas from the 450-psi absorber is piped through a dry gas scrubber, meter, and back-pressure regulating valve. There it splits, one part of the gas being taken through another back pressure regulating valve and delivered to the gas company's glycol dehydration unit, the other part being piped to the 450-psi dry gas compressor suction header. The 450-psi dry gas is compressed to 500-600 psi as desired and is piped to atmospheric coolers in the induced draft cooling tower, to the dry gas chiller, and to a scrubber. From the dry gas scrubber the gas passes to a sales meter and to the other gas company's pipeline distribution system.

The fuel for the boilers and fired type preheater is taken from the 35-psi absorber primarily with a make-up connection from the compressor fuel piping. The dry gas at 140-150 psi passes from the absorber through a meter and back pressure regulating valve to field fuel. The compressor fuel connection is taken off ahead of the meter. The compressor fuel passes through a reducing regulator, where it is reduced to around 30 psi, to a scrubber. Into the fuel gas line to the scrubber there is connected an emergency 50-psi wet gas connection for make-up purposes

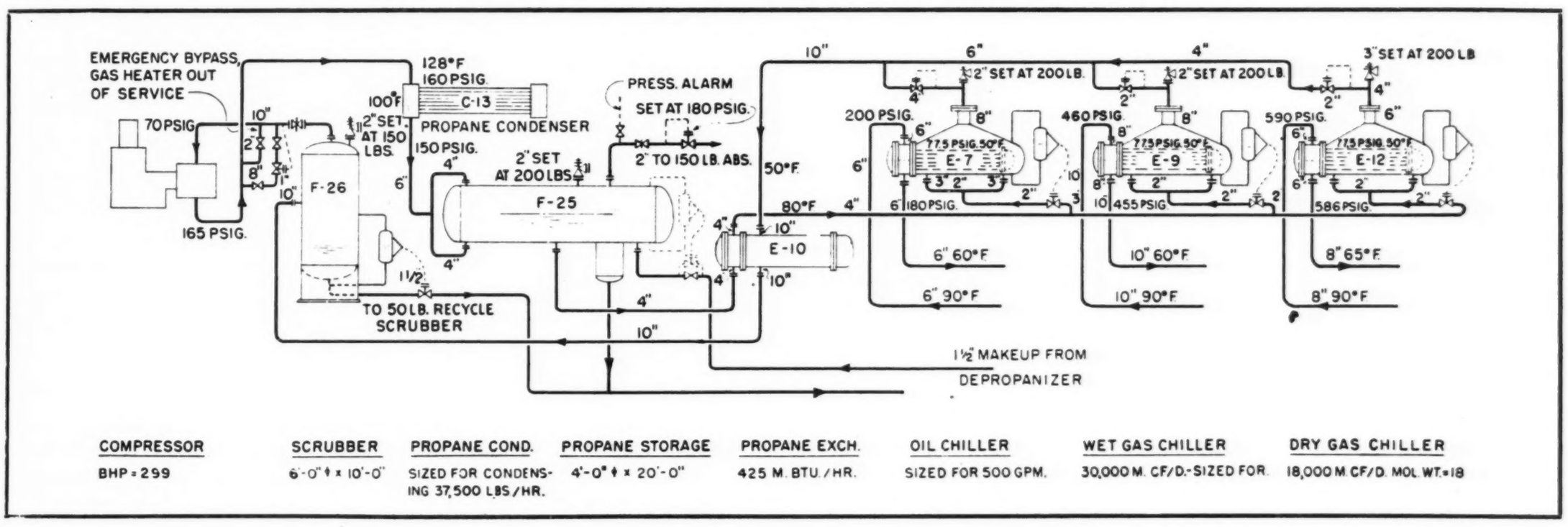


Fig. 3. Flow sheet for propane refrigeration unit.

—in case the fuel pressure should drop too low—and for emergency shutdown purposes. The compressor fuel pressure is further reduced in pressure for the four-cycle gas engine-driven auxiliary pumping equipment, and is still further reduced at each gas engine-driven compressor to around 15 psi by the compressor fuel regulating valve.

All of the main gas services pass through a meter manifold. Each gas service is protected with a stack-to-air line in which is installed a back pressure regulating valve. On each service stack-to-air line is installed a meter for measuring any gas that might pass to the air due to irregular plant operation. Each service stack-to-air line is connected into one common large stack line which is located in the southwest corner of the plant at a safe distance away from all equipment.

Compressor Station

The compressor station consists of two Clark type RA-4 two-cycle 400-hp gas engine compressor units which were moved from another gasoline plant; three Clark type RA-5 two-cycle 500-hp gas engine compressor units; two gas engine-driven and one steam turbine-driven engine circulating water pumps; starting air compressor and instrument air compressor, both gas engine driven; and two additional bays of building for parts storage and for overhaul and for maintenance work.

To select the layout for the compressor station, certain quantities of gas were selected from the field data, together with the gas analysis and the process calculations. From this data the compression ranges and capacities selected are observed to be as follows: 3600 Mcf of 45-psi wet gas to be compressed to 155 psi, designated as gas A; 14,100 Mcf per day of 150-psi wet gas, to be compressed to 460 psi, designated as gas B; 14,000 Mcf per day of 450-psi dry gas, to be compressed to 600 psi, designated as gas C; 1500 Mcf per day of 35-psi still vapors, to be compressed to 160 psi, designated as gas D; and 7325 Mcf per day of propane gas for refrigeration, from 70 psi to 165 psi or from 55 psi to 165 psi range, designated as gas E.

The total horsepower for compression that is represented by these figures is approximately 1800-1870. About the time the layout was decided upon it was further requested that the quantity of 50-psi wet gas be increased to 6000 Mcf per day and that 100% spared capacity be provided for the 450- to 600-psi compression service or gas C.

In the layout of the compressor station, provisions were made so that in case of an engine shutdown the load could be shifted to completely load the remaining units in operation, and in case there was an excess quantity of wet gas it could be processed through the 150-psi absorber and allowed to go to air if necessary. Final arrangement of the compressor unit sizes was selected on this basis, with the thought in mind that the gas engines were two-cycle, which should be operated under a full load condition in order to obtain the best operation. Equipment on hand also had to be fitted into the arrangement.

Alternate Setup

Clearance pockets, valve lifters, and valve-in-head unloaders were selected so that the compressor cylinders could be operated under two alternate pressure conditions and under two alternate gas services in some cases. In the following table, which shows the final arrangement selected, it is to be noted that there are three compressor cylinders mounted on each gas engine unit. This has been designated as *Table 1.*

TABLE 1.

Location		Gas	
Unit No.	Engine H.P.	Compressor Gas Service	Cylinder Size
K-1	400	Recycle Gas	12"x14"
		Propane	12"x14"
		Propane Gas " "	(2)12"x (2)12"x
K-2	400	50# Wet Gas	12"x14"
		Recycle Gas	12"x14"
		150# Wet Gas	(2)7"x1
K-3	500	50# Wet Gas	12"x14"
		150# Wet Gas	(2)7-3/
K-4	500	50# Wet Gas	9¼"x14"
		150# Wet Gas	9¼"x14"
		150# Wet Gas	7 3/4"x
		430# Dry Gas	7 3/4"x
		150# Wet Gas	7 3/4"x
		430# Dry Gas	7 3/4"x
K-5	500	50# Wet Gas	9¼"x14"
		150# Wet Gas	9¼"x14"
		430# Dry Gas	(2)7-3/
		150# Wet Gas	(2)7-3/

The compressor engine jacket water circuit is a closed system. The engine jacket water is circulated by means of two direct-connected gas engine-driven centrifugal water pumps and a spare steam turbine-driven standby. The pumps take suction on the surge tank and pump the water through the engine jackets. From the engine jackets, part of the water passes through the compressor cylinder jackets and back to the surge tank, the other part of the water being piped to atmospheric cooling coils in the induced draft cooling tower and then to the surge tank. A bypass line is also installed from the water line to the cooling coils back into the surge tank. This bypass, together with the water from the compressor jackets, is used to control the temperature of the engine jacket water at around 120° F.

Since the atmospheric cooling sections are designed with a low pressure drop, an extra pressure of only approximately 5 psi is added to the engine jacket pressures. The hot engine jacket water circulating to the compressor jackets results in longer ring life and less compressor cylinder wear when operating on wet gas. The engine lubricating oil coolers are cooled by a separate water circuit, which is taken from the discharge of the induced draft cooling tower circulating water pumps and returned to the cooling tower basin.

Induced Draft Cooling Tower

Preliminary weather investigation revealed periods as high as 30 days with very little wind available and at the same time wet bulb temperatures as high as 72° F. Also, it was found that ground fogs due to irrigation at certain times of the year caused high wet bulb temperatures and high humidity conditions. This data led to the consideration of the installation of an induced draft cooling tower.

A study of various induced draft designs led to the installation of a 24 bay, 6 cell tower, 24 ft wide by 144 ft long by 40 ft high. On the top of each cell of four 6-ft bays was installed a 12-ft diameter induced draft fan assembly consisting of six stainless steel fan blades mounted horizontally on top of a gear box driven by a gas engine. Twenty-foot long atmospheric cooling sections were arranged so that they could be stacked four high in the base of the cooling tower. The guaranteed rating of the cooling tower stated that the cooling tower would cool 7200 gpm from 100° F to 80° F with a 72° wet bulb temperature. This represented 0.4 in. of water draft in the entrance of the fan duct, which equals a fan velocity of approximately 302 ft per minute.

Design Features

Design features in this tower include the following:

1. Six stainless steel fan blades installed in each cell.
2. Fans driven by a BZU Waukesha gas engine through a 5-to-1 Western Gear.
3. Draft eliminators to prevent water from being carried from the tower.
4. Removable cooling water decks of sufficient strength to permit removal for cleaning and hosing off.
5. Vapor stack with damper, installed ver-

COMPRESSOR DETAIL DATA FOR GENERAL AND ALTERNATE OPERATION

Cylinder Size	M^2CF	Suct. Pressure	Disch. Pressure	Suct. Temp. °F	Clearance %	V.E. %	Comp. B.H.P.	Alternate Service: Gas Symbol	M^2CF	Suct. Pressure	Disch. Pressure	Suct. Temp. °F	Clearance %	V.E. %	Compr. B.H.P.
		p.s.i.	p.s.i.							p.s.i.	p.s.i.				
"x14" "x14"	1.35	35	160	90°	22.6	55.5	100	E	1.47	55	165	80°	9.32	80.0	50
)12"x)12"x	6.50	70	165	80°	26.0	72.5	300	A	5.32	45	155	90°	9.32	84.0	342
								E	5.62	55	165	80°	11.9	76.2	317
"x14" "x14"	2.62	45	155	90°	12.6	79.5	162	D	1.35	35	160	90°	17.2	51.5	100
)7"x1	3.56	150	460	90°	24.3	62.3	230	B	4.74	150	460	90°	7.16		306
"x14"	2.66	45	155	90°	9.3	84.0	171	None							
)7-3/4	5.10	150	460	90°	17.5	72.3	328	None							
"x14" "x14"	1.50	45	155	90°	11.3	81.0	97	B	1.74	150	460	90°	20.4	68.0	112
	(Single acting)(Double acting multiply by 2----→														
3/4"x 3/4"x	3.00	150	460	90°	8.4	85.0	194	C	9.0	430	600	90°	8.4	94.5	199
	Variable volume 4.5 M^2CF to 9.00 M^2CF unloader--→														
3/4"x 3/4"x	3.00	150	460	90°	8.4	85.0	194	C	9.0	430	600	90°	8.4	94.5	199
	(Fixed operated fixed clearance)														
"x14" "x14"	1.50	45	155	90°	11.3	81.0	97	B	1.74	150	460	90°	20.4	68.0	112
	(Single acting)(Double acting multiply by 2----→														
7-3/4 7-3/4	18.00	430	600	90°	8.4	94.5	398	←---Variable Volume 14.5 M^2CF to 18.0 M^2CF							
	Variable volume 4.5 to 6.00 M^2CF----------→							B	6.00	150	460	90°	8.4	85.0	388

Note: Balanced total compressor horsepower for each unit equals the rated engine horsepower for each service and for maximum gas loading for each compressor cylinder. At a later date Unit No. K-1 was connected to the 50-lb wet gas service for use during the winter months until another compressor unit could be installed. Due to the excellent performance of the induced draft cooling tower it was found possible to shut the propane refrigeration unit down during the winter months. This also provides another emergency spare setup in case another compressor goes down.

tically from the atmospheric cooling section through the drift eliminators to permit the removal of hot water vapor.

6. Double outside ventilated wall construction.
7. Pickup and redistribution system with water control levers carried down to permit operation from the ground.
8. Special hot water control arrangement on certain cooling sections; i.e., cooling gas that has to be maintained above 60° F to prevent the formation of hydrates.
9. Alternate spacing of coils with passageway between to permit easy access for cleaning.
10. Stacking of atmospheric cooling sections with cold services above hot services so as economically to permit the flow of sufficient water over the coils in order to reduce scaling tendencies.

In *Table 2* is shown an approximate distribution layout for the water and for the heat loads in the induced draft cooling tower.

The Bechtel Corp. made the necessary drawings and constructed the gasoline plant under the direction of the engineers for the General Petroleum Corp.

Similarly the Pacific Pipe Line Construction Co. installed the field gathering system, including the gas booster compressor stations.

TABLE 2. INDUCED DRAFT COOLING TOWER ARRANGEMENT AND HEAT DATA

CELL Number	1				2				3				4				5				6			
BAY Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Water Cooled per Bay	1200 G.P.M.				1200 G.P.M.				1200 G.P.M.				1200 G.P.M.				1200 G.P.M.				1200 G.P.M.			
Maximum	1350				1350				1350				1350				1350				1350			
Required over Coils	1950				0-1300				1230				1220				500-1000				1400 G.P.M.			
Water Flow Across Deck	750 G.P.M. ←								←450G.P.M.				←480		(0)	←500					←---200 G.P.M.			
Excess	900 G.P.M.																							
	BAY RATING																							
M.B.T. u's	5.25		6.10	7.80					3.40	1.50		5.00	4.00		4.00	2.18			6.00		6.00	6.00		3.00
G.P.M.	600		600	750		600	700		450	350		500	460		460	300		500	500		500	500		400
Temp. Rise F	17.5		20.5	21.0		-	-		15	11		20	17.5		17.5	14.5								
Tubes Number	42		42	54		42	50		34	26		38	32		32	21		36	36		36	36		28
Size	1"		1"	1"		1"	1"		5/8"	5/8"		5/8"	1"		1"	1"		1"	1"		1"	1"		1"
GPM per tube	14.3		14.3	13.9		14.3	14.0		13.2	13.5		13.2	14.3		14.3	14.3		13.9	13.9		13.9	13.9		14.3
Box style	Open		Open	Open		Open	Open		Closd	Closd		Closd	Open		Open	Open		Open	Open		Open	Open		Open
	COIL RATING																							
ARRANGEMENT	C-1 / C-12 / C-12		C-5 / C-6 / C-12 / C-12	C-10 / C-10 / C-12 / C-12	Vacant	Spr.	Spr.	Vacant	C-2 / C-2 / C-2	C-3 / C-3 / C-11	Vacant	C-7 / C-7 / C-7	C-4 / C-4 / C-4	Vacant	C-4 / C-4 / C-4	C-4a / C-4a / C-4a	Vacant	Spr.	C-13 / C-13 / C-5 / C-5 →		C-13 / C-13 / C-5 / C-5 →	C-13 / C-13 / C-5 / C-5 →	Vacant	C-5 / C-5 / C-5 / C-5
G.P.M. Design	360		600	750					300	280		500	320		320	210			400		400	400		400
Temp. Rise °F	7°		7°	10°					23	7°		20	19		19	19°			10°		10°	10°		15°
GPM Design	600		600	600					-	280		-	-		-	300			400		400	400		400
Temp Rise °F	13°		13°	13°					-	3½°		-	-		-	1°			20°		20°	20°		-

Note: *Coil Designation.* C-1 150-lb Wet Gas-A. C-2 450-lb Wet Gas-B. C-3 600-lb Dry Gas-C. C-4 Lean Oil Coolers. C-5 Gasoline Condensers. C-6 Recycle Gas-D. C-7 De-propanizer Condensers. C-8 Propane Cooler. C-10 De-butanizer Condenser. C-11 Stabilized Gasoline Cooler. C-12 Jacket Water Coolers-Engine Jacket. C-13 Propane Condensers, Refrigeration Cycle.

Election Day in the Laundry

Gas Clothes Dryers Enthusiastically Receiv

By MARY N. HALL

GAS clothes dryers constitute a challenge, not only to home service, but to the gas industry as well. A new gas appliance is now available which means an absolutely new load on gas mains; not a replacement or an augmented one. Seventy per cent of this new load is in the upper brackets of the rate structure and therefore is a profitable one.

Another strong point in favor of dryers is that women love them once they have the opportunity to use them. We loved them ourselves when first we saw and used them. We realized their possibilities both so far as the user was concerned and also so far as the merchandizer was concerned. When it was possible to stock an adequate supply of dryers, we tried to sell them but met with stubborn resistance. Women liked the idea. They thought a clothes dryer would be wonderful to have. But they had always hung their clothes on a line to dry and they would continue to do so. The money a dryer cost could be used to better advantage elsewhere.

In the meantime, the enthusiasm of the home service department for the dryer was growing. We felt that while the automatic water heater, washer and ironer had done much to eliminate the drudgery of washday, still one of the worst jobs remained—either hanging up the clothes to dry outside in all kinds of weather or strewing them all over the house. The automatic clothes dryer had at last done something about the weather, not to mention saving steps and eliminating the hazards involved in lugging heavy baskets of wet clothes. We were convinced that if a woman once used a dryer, she would like it.

Launching The Test

So we approached a selected list of our customers located strategically throughout our whole territory, and asked them if they would cooperate with us in trying out this new gas appliance we thought so desirable. We explained that actual use in the home was the real test of any appliance and that their cooperation in this respect would be of great value to us, to the manufacturer, and to women in general. There was no cost to the customer involved, but a time limit of 30 days was put upon the test. At the end of 30 days, in return for her kindness in making the test, if she were satisfied with the dryer we offered to rent it to her at a small monthly rental. If she were not satisfied, we would remove it at once, without charge. We had no trouble in placing 50 dryers under these conditions and as we had believed, once a woman used the dryer she would not part with it.

We placed these preliminary selected dryers during the period of June 3 to July 15. We hoped the infection would spread. It did. From July 16 to Aug. 15, 229 additional dryers were installed on a similar basis but at a slightly increased rental. We knew then that the dryer was not another gadget but an appliance which women liked, which they used, and which finished the job of taking the hard work out of home laundry. At that time, Aug. 15, we discontinued the trial offer but continued the rental plan at $3 per month. As of Jan. 14, we have 557 dryers operating in the homes of our customers.

Questionnaire

We wanted to know the reaction of these women to the dryers after they had been in use—so we prepared a questionnaire asking direct questions which called for direct answers.

The survey covers 270 dryers which have been in operation for 30 days or more. Of the 270 dryers covered by the survey, two were returned; one because the whole house went electric and the second because of domestic friction between husband and wife. Of the 270 women interviewed 123 liked the convenience of the dryer more than any other one feature; 97 liked the finished product; 33 liked "just everything" about it and the remainder had a variety of likes. We also asked these women what they did not like about the dryers. Seven definitely disliked the moisture, 5 the lint, and 19 had various dislikes which in most cases could be traced to improper use of the dryer. The remaining women—240—had no definite dislikes or hesitated to say there was anything they disliked. Under "Improvement Suggestions," 14 wanted bigger and better lint traps, 9 a flue for moisture and 19 wanted various miscellaneous improvements leaving 235 with no suggestions to offer.

An indication of load potential was contained in questionnaire replies, which showed that use varies from one hour per week to 24. Fifteen used theirs one hour, 34 two hours, 24 three hours, with six hours the most frequent —appearing in 50 replies. Ten per cent used the machine over nine hours a week. Only 17 waited for bad weather, while 41 used a dryer every day.

For other findings, consult the table.

Results

We believe that much of this satisfaction derives from the fact that we got our customers off on the right foot in using the dryer. As soon as a dryer was installed, a home service girl called at the home, on definite appointment, and helped the customer use the dryer for the first time. Actual family wash was done and dried. This gave the home service girl an opportunity to check the washing technique all along the line; hot water supply, soap, water softener, starching, use of the automatic washer in particular (many women do not use them correctly), tension of wringers, kinds of load, ironing methods, etc. It also gave her an opportunity to check the actual drying time in the dryer and to show how clothes can be removed ready for ironing or ready to be folded.

The most important point covered in this call, however, was the moisture and lint. We found that if the moisture and lint were explained as they occurred, the customer accepted the fact

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Mrs. Hall, home service director for Elizabethtown Consolidated Gas Co., Elizabeth, N.J., presented this paper at the AGA Home Service Workshop in Cleveland, Jan. 24-27.

eiv Market Tryout

that they were inevitable in the drying of clothes, and it wasn't the shock to her which it might have been had she used the dryer by herself for the first time. We think this is the one reason why moisture and lint have not constituted a problem, although as you will note from the survey there are more objections on both these scores than on any other.

We have done no advertising whatsoever in putting across these dryers. Results have been achieved mainly through the recommendations of the satisfied users who were only too happy to spread the news. We believe this is due to the careful instructions the customers received on the operation of the dryer before any bad usage habits were developed.

The Challenge

This is where the challenge to home service comes in. The best sales promotion in the world will fall far short of success if the dryer does not come up to the customer's expectations. It is up to home service to see that it does, and in order to do this each home service girl, in addition to knowing the mechanical operation of the dryer, *must:*

1. Be thoroughly sold on the dryer before any attempt is made to demonstrate it to a potential customer or a user.
2. Have an opportunity to use the dryer under actual home conditions.
3. Know good laundry technique.
4. Be familiar with standard washing machines.
5. Know whether or not the automatic washer or wringer type washer is doing a satisfactory job of water extraction.
6. Know the problems involved in starching clothes ready for the dryer.
7. Know detergents and water softeners.
8. Know the "feel" of the clothes as they come from the dryer; whether ready for ironing or for folding to put away.
9. Know approximate times for drying various materials.
10. Know how to present the moisture and lint condition in such a way that it will be minimized in the customer's mind.
11. Know how to outweigh what might be termed "disadvantages" with the many advantages the dryer does possess.
12. Know how to help the housewife plan her work and time to receive the greatest benefit from the dryer.

The Returns Are In

267 Like
2 Returned
(1 bought electric model
(1 husband objected
1 Dislike
Not returned (domestic problem)
270

ANALYSIS OF LIKES

123 Convenience
(Less work
(Wash any time
(No hanging clothes
(Fast drying
(Time saving
(Weather no problem
(Can plan work in advance
(Maid wash and iron in one day
97 Finished Product
(Softness and fluffiness
(Towels
(Bedspreads
(Rugs
(Shape—socks particularly
(Baby and children's clothes
(Work clothes
(Corduroys
(Chenilles
(Way all clothes dry
(Whiteness
(Starch evenly distributed
33 Everything
6 No clothes hanging outside spoiling appearance of yard
3 More time to care for children
1 Physically handicapped — able to complete laundry
1 Saves excessive supply of baby clothes
1 Avoids chapped hands
1 No carrying wet clothes from cellar
266
2 Returned
1 Personal problem
1 No reply
270

SECONDARY LIKES

Convenience
Finished products
Easier and less ironing
Any time is laundry time
Safety
No clothes line (cellar or yard)
No clothes pin marks
No hanging of clothes
Lint removed from clothes
Clean smell
Don't have to leave children
Saves excessive supply of baby clothes
Laundry not interfering with household schedule
Rugs, slipcovers, spreads
Girdles, rayons

DISLIKES

7 Moisture
5 Lint
4 Sheets, towels, table linens limp
4 Too long
3 Shrinkage of certain kinds of diapers, knit goods, rayons, polo and T shirts
1 Waist bands on shorts curl
1 Too warm
1 Removes "outing" from outing flannel
1 Unable to do wool fabrics
1 Sheets wrinkle
1 Yellowing of white clothes
1 Things wear out quicker

IMPROVEMENT SUGGESTIONS

14 Larger and better lint traps
9 Flue for moisture
5 Longer interval timer
2 Washer and dryer in one unit
2 Drop leaf shelf
2 Quicker drying
2 Opening on top
1 Larger drum
1 Dryer grounded in case of short
1 Temperature control
1 Bell on timer
1 Quieter
1 Sun bulb for bleaching

SERVICE CALLS
82 Service Calls on 270 Dryers

18 Pilots would not stay on
6 Pilots—stoppage-spiders, etc.
11 Timers
9 Burner adjustments
8 Belts
7 Electric connection
3 Fuse plugs
3 Noisy
3 Lint—back-trapped
2 Basso valve
2 Door adjustment
2 Thermostat
2 Motor
1 Not level
1 Drum changed—clothes catching on weld
1 Glass broken
1 Over loading by customer
1 Customer forgot to turn "on position"
1 Gas leak
82
(6 dryers exchanged for mechanical reasons)

METHOD OF WATER HEATING

136 Gas automatic
89 Oil
31 Gas manual
13 Pot stove—coal
1 Electric
270

WASHING EQUIPMENT

151 Automatic
84 Wringer
31 Spin Dry
4 Other (outside home, by hand, baby washer)
270

IRONING EQUIPMENT

208 Hand iron
19 Ironer
43 Both
270

WOULD RECOMMEND DRYER TO FRIENDS

270 YES
..... NO

PILOT KEPT ON

242 OFF
28 ON
270

Interchangeability of Oil Gas With Natural Gas

By ARTHUR W. KRAUSE and A. M. CUNNINGHAM

Importance of High-Btu Oil Gas

MUCH THOUGHT AND EXPERIMENTAL WORK has been devoted in recent years to the study of oil gas manufacture by individuals, companies and colleges. This has been due mainly to the following factors:

Increased consumption of gas has caused increased gas supply demands.

Supply of natural gas often cannot meet these increased demands.

Natural gas supply may decrease in certain localities in the future.

Shortage and cost of pipeline has led to consideration of a high-Btu gas.

Cheap grades of oil have been found practical for oil gas manufacture.

A clean, flexible, inexpensive, automatic process is desired by the gas industry to handle peak load demands.

The fact that The Gas Machinery Co. has installed or converted 34 plants, using a solid fuel process for which the original development was started in 1933, is an indication of the increased commercial use of oil gas by gas utilities, both as a peak load and as a base load. Later modification and development resulted in a 100% oil process now known as "Hi-Btu Oil Gas." This may utilize either single or twin generators of which 40 installations have been made during the past two years and considerable work is scheduled for the future.

AGA Interchangeability Data

"Interchangeability of Other Fuel Gases with Natural Gases,"[14] Research Bulletin No. 36 of the American Gas Assn. Testing Laboratories, and previous other related mixed gas research reports have covered a large number of fuel gases, but oil gases were not considered for supplementing natural gas, perhaps because of the fact that they were relatively unknown at that time.

The recent AGA Testing Laboratory Research Report No. 1106-A, "Interchangeability of Other Fuel Gases With Coke Oven Gas,"[15] has provided a great deal of actual interchangeability data and computed indices related to substitution of oil gas-diluent gases* for coke oven gas. In the near future similar reports regarding interchangeability of other fuel gases with carburetted water gas (low inerts), carburetted water gas (medium inerts), carburetted water gas (high inerts), mixed coke oven gas-carburetted water gas, and natural gas-blue gas-cracked natural gas-producer gas are expected to be published.

Mixtures of oil gas and diluent gases which were employed in this mixed gas research investigation[15] were made up generally from an oil-gas having a heating value of 1500 Btu per cu ft.

In Bulletin No. 10, "Research on Fundamentals of Atmospheirc Gas Burner Design,"[16] characteristic lifting and yellow tip limit curves are presented for a typical oil-gas and natural gas as obtained with the AGA precision burner. These curves indicate that the per cent primary air, at which yellow tips and lifting begin to develop, is much lower (approximately 20%) for natural gas than for oil gas.

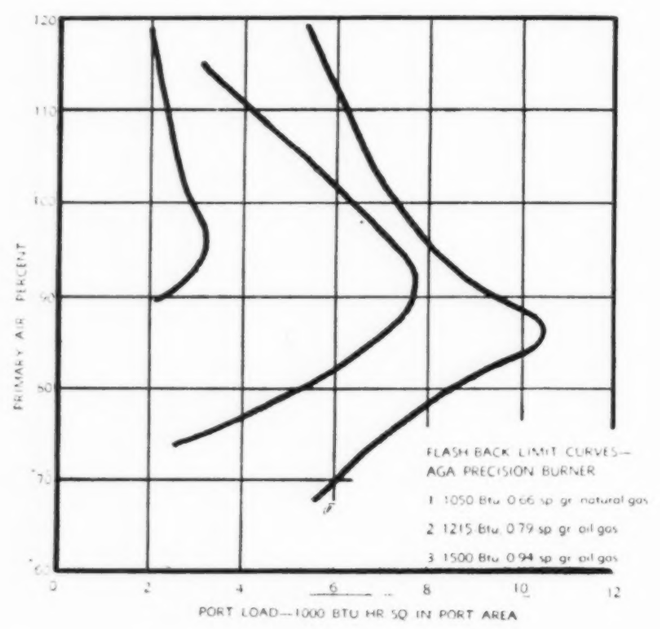
PRIMARY AIR PERCENT
FLASH-BACK LIMIT CURVES—
AGA PRECISION BURNER
1 1050 Btu 0.66 sp gr natural gas
2 1215 Btu 0.79 sp gr oil gas
3 1500 Btu 0.94 sp gr oil gas
PORT LOAD—1000 BTU HR SQ IN PORT AREA

Fig. 1. Flash-back limit curves. Curve 1 is at left; Curve 2, center; Curve 3, right.

Experimentally determined flash-back limit curves are presented in *Fig. 1* for a 1050-Btu natural gas and for a 1215-Btu and 1500-Btu oil-gas which will indicate the greater flash-back characteristics for the oil gases. Flash-back occurs within the boundary of the curve. These flash-back limit curves were obtained also with the AGA precision burner using a different burner head.*

Reference Reading

THE READER MAY WISH to review the history, the economics and the equipment and processes for high-Btu oil gas production as a background for this article. Accordingly, he may refer to recent recommended pertinent articles listed in the bibliography (Nos. 1-13).

*Diluent gas-air, producer gas, blue gas and unenriched reformed natural gas, all having values less than 320 Btu per cu ft.

*Recent research—unpublished data.

UTILITIES are mainly interested in an oil gas with a heating value much lower than 1500 Btu, and accordingly this article will deal with such oil gases, approximately 900-1200 Btu.

Interchangeability of oil gases and oil gas-air mixtures with utility gases is presented herewith only by means of the AGA calculation method[14,15] since at the present time it apparently is the most reliable.[17]

The study has been confined to an interchangeability problem relative to the proper operation of domestic and commercial appliance burners of the atmospheric type.

Gas Analyses

Gas analyses for various typical natural gases and oil gases studied in this article are presented in *Table 1*. These data were taken from various actual analyses supplied mainly by companies employing or manufacturing these gases. The breakdown into individual constituents for the illuminants was estimated in most cases from previous analyses of oil gases obtained at the AGA Laboratories with a Turner-Burrell Adsorption Fractionator. This breakdown as indicated in *Table 1* agrees in general with an analysis breakdown for certain oil gases by Podbielniak distillation.[12]

A table of "High Btu Gases from Gas Oil or Diesel Oil"[12] has been prepared by Edwin L. Hall. The analyses for the seven oil gases presented indicate that these gases may consist of blue gas (3-16%), oil gas (70-85%), and products of combustion and air (less than 10% except for twin generator type operation, in which up to 27% may occur). On this basis the heating value of oil gas would increase above the value normally reported for the combined oil-gas mixture.

The knowledge that the character of the illuminants as obtained by analysis would aid in determining interchangeability has been recognized in the

The writers of this article, Mr. Krause and Mr. Cunningham, staff engineers at The Gas Machinery Co., Cleveland, are both familiar with interchangeability problems, having previously been associated with experimental, analytical and calculation phases of gas interchangeability research at the American Gas Assn. Their present duties with The Gas Machinery Co. include engineering analysis of customers' interchangeability projects.

past.[18] It is surprising that such little investigation has been made with regard to illuminants analyses by gas utilities, especially in view of the fact that the composition of these illuminants may cause unsatisfactory burner performance. Acetylene, for example, is very seldom determined by gas utilities, although it may exist in oil gases[18] and cause flash-back difficulties since acetylene has an unusually high ignition velocity, approaching that of hydrogen.[19]

The specific gravities and heating values listed in *Table 1* are observed values. They agree reasonably well with values calculated from the analyses with the exception of the specific gravity of the 1215-Btu oil-gas, the calculated value here being quite a bit lower.

AGA Indices

Table 2 contains the calculated AGA Interchangeability indices for lifting "I_l", flash-back "I_f" and yellow tips "I_y." In addition, factors used in determining these indices and the theoretical change in burner input rating are included.

AGA equations used to determine "I_l", "I_f" and "I_y" are presented below:

Lifting Interchangeability Index:

$$I_l = \frac{Ka}{\frac{f_a\ a_s}{f_s\ a_a}\ (K_s - \log \frac{fa}{f_s})}$$

Flash-back Interchangeability Index:

$$I_f = \frac{K_s\ f_s \sqrt{\frac{hs}{1000}}}{K_a\ f_a}$$

Yellow Tip Interchangeability Index:

$$I_y = \frac{f_s\ a_a\ (Ya)}{f_a\ a_s\ (Y_s)}$$

Nomenclature for the terms in the equations above is as follows:

A = air theoretically required for complete combustion, cu ft per foot of gas.

a = air theoretically required for complete combustion, cu ft per 100 Btu of gas $= \frac{100\ A}{h}$

d = specific gravity (air = 1.0)

E = total inerts in gas mixture, decimal volume

F = lifting constant

f = primary air factor $= \frac{1000 \sqrt{d}}{h}$

h = gross heating value, Btu per cu ft

I_f = index of flash-back interchangeability

I_l = index of lifting interchangeability

I_y = index of yellow tip interchangeability

TABLE 1—CHEMICAL COMPOSITION AND PROPERTIES OF GASES

Type of Gas	Nat. Gas Low Inert	Nat. Gas High Inert	Oil Gas	Oil Gas	Oil Gas	Oil Gas
Heating Value Btu/cu ft	1040	1014	977	960	1215	1500
Specific Gravity	0.635	0.677	0.63	0.74	0.79	0.94
Blue Gases:						
CO			2.6	1.1	0.5	1.1
H_2			24.2	18.5	21.5	16.0
Sub-Total			26.8	19.6	22.0	17.1
Hydrocarbon Gases:						
Saturated						
Ch_4	86.7	73.5	43.8	32.9	38.9	28.5
C_2H_6	10.4	15.1	2.2		6.0	6.4
C_3H_8					0.7	1.0
Sub-Total	97.1	88.6	46.0	32.9	45.6	35.9
Unsaturated:						
C_2H_4			16.4	17.6	18.9	26.6
C_3H_6			1.1	3.5	9.3	13.5
C_4 +			3.6	3.5	3.0	4.8
Sub-Total			21.1	24.6	31.2	44.9
Non-Combustible Gases:						
CO_2	0.1		1.1	4.2	1.2	1.9
O_2	0.9	0.5	1.0	1.7		0.2
N_2	1.9	10.9	4.0	17.0		
Sub-Total	2.9	11.4	6.1	22.9	1.2	2.1

K = lifting limit constant $= \frac{F}{d} = \log R + 0.016L$

L = lifting limit, percent primary air

O_2 = oxygen in gas mixture, decimal volume

R = input rate, $\frac{But/hr/sq\ in.\ of\ port\ area}{10{,}000}$

T = yellow tip constant, cu ft of air required to eliminate yellow tips per cu ft of gas

Y = yellow tip limit, per cent primary air $= \frac{100\ T}{A + 7E\text{-}26.3\ O_2}$

Subscript a = adjustment gas

Subscript s = substitute (or supplemental) gas

The method of employing these equations for prediction of interchangeability has been indicated by example calculations in various literature.[14,19]

From *Table 2* and from other observations, the following is indicated (assuming distribution pressures remain the same):

1. Some flash-back complaints are indicated upon conversion to any of the three oil gases for some burners adjusted with hard flames because of these facts: (a) I_f values for the substitute gases are equal to or greater than 1.2, the limiting value reported in AGA Bulletin 36[14]; (b) the K value for the oil gases are greater than the K value for the two natural gases, indicating a greater ignition velocity for the oil gases and consequently probable flash-back difficulties; (c) Flash-back limit curves show that oil gases have a greater tendency than natural gas.

For burners adjusted with soft and normal flames on either of the natural gases, no flash-back difficulties would be expected for any of the oil gases. Occurrence of flash-back is further enhanced with decreased input rate occurring upon substitution. Computations for change in burner input rate were made on the basis that the change is directly proportional to heating value and inversely proportional to the square root of the specific gravity.

2. Since the I_l value is equal to or less than 1.0, no lifting difficulties should occur upon substitution of the oil gases for the 1014-Btu natural adjustment gas. This would be true even for burners adjusted with hard flames on natural gas.

With the 1040-Btu natural adjustment gas, conversion to the 960-Btu oil gas only would tend to produce slight lifting because of the I_l value of 1.1. These complaints would be inappreciable, however, since they would be an-

TABLE 2—CALCULATED INTERCHANGEABILITY INDICES FOR OIL GASES USED AS SUBSTITUTES FOR TWO TYPES OF NATURAL ADJUSTMENT GASES

	1014 Btu-0.68 sp gr Nat. Gas (high inerts) as Adjustment Gas				1040 Btu-0.64 sp gr Nat. Gas (low inerts) as Adjustment Gas			
	1014 Btu 0.68 sp gr nat. gas	*1215 Btu 0.79 sp gr oil gas*	*977 Btu 0.63 sp gr oil gas*	*960 Btu 0.74 sp gr oil gas*	*1040 Btu 0.64 sp gr nat. gas*	*1215 Btu 0.79 sp gr oil gas*	*977 Btu 0.63 sp gr oil gas*	*960 Btu 0.74 sp gr oil gas*
AGA Flash-back Interchangeability Index I_f		1.194	1.31	1.33		1.228	1.35	1.33
AGA Lifting Interchangeability Index I_l		0.742	0.772	1.02		0.860	0.836	1.11
AGA Yellow Tip Interchangeability Index I_y		0.55	0.696	0.845		0.606	0.767	0.935
Air theoretically required for complete combustion per 100 Btu "a"	0.938	0.926	0.920	0.832	0.958	0.926	0.920	0.832
Primary Air factor "f" $= \frac{1000\sqrt{d}}{h}$	0.809	0.732	0.812	0.896	0.766	0.732	0.812	0.896
Lifting Limit Constant "K"	1.179	1.412	1.568	1.40	1.211	1.412	1.568	1.400
Yellow Tip Limit "Y"	24.2	40.4	35.6	35.8	24.8	40.4	35.6	35.8
Theoretical % change in input rate to burners		+10.9	—0.2	—9.6		+4.5	—4.0	—14.4

ticipated to occur only for a few burners adjusted with hard flames.

3. On the basis of I_y allowable limits of interchangeability for natural gases given in Bulletin 36,[14] the calculated I_y indices, presented in *Table 2*, indicate that an appreciable amount of yellow tips would occur with the 1215-Btu substitute oil-gas and only slight yellow tips would be anticipated upon substitution of the 977-Btu oil gas or the 960-Btu oil gas. Yellow tips would be expected only for burners adjusted with soft flames on either of the natural gases.

An index of yellow tip formation can be obtained from the "Y" and "f" values. The "Y" value for the substitute gas should be less than that for the adjustment gas to avoid yellow tips. If this is not the case, greater air injection by the substitute gas as indicated by a higher primary air factor will help avoid yellow tips.

4. The best interchangeable gas for either of the two adjustment natural gases would be the 960-Btu oil-gas, which should be capable of being substituted 100% without unusual customer reaction, provided burners are adjusted with soft-to-normal flames, preferably the latter.

5. Appliance conversion from a natural gas to an oil gas is inexpensive, since the major adjustments necessary would be some simple air shutter changes. For some burners having non-adjustable air shutters, other readjustment means may have to be provided.

Operational Experience

Table 3, "Operational Experience with Gas Interchangeability Problems of Oil Gas with Natural Gas," was prepared from information received from various companies through field inspection, correspondence, and from certain technical articles.

Another company reported using 100% 900-Btu oil-gas for 15 days on its system, whose base gas is a 900-Btu mixed gas made by mixing 1040-1140-Btu natural gas with a manufactured gas which varies from a modified blue gas of 150-Btu and/or carburetted water gas of 600-Btu and/or 1000-Btu oil gas. A large amount of pilot outage and/or orifice stoppage occurred due to gum formation.

As may be noted, oil gas was employed in quantities from 40% to 100% substitution. Minor complaints occurred upon substitution which could be solved mainly by simple air shutter adjustment.

In the case of "Company 4," Leon Willien reports[20] that complaints were classified as follows:

Leaks	29.1%
Flash-backs (water heaters)	10.2%
Yellow tip flames	59.7%
Miscellaneous	1.0%

Leak calls were responsible for a considerable proportion of the total service calls for most companies. These leaks in general are insignificant and were unnoticed with natural gas; however, because of the penetrating, pungent, and unfamiliar odor of the oil gas, typical of manufactured gases, complaints occurred. These difficulties will probably be minimized after customers become accustomed to the oil gas odor.

Flash-back or noisy extinction was encountered on certain burners where the port area per unit Btu input was large. Yellow tips, of course, will occur where primary air entrainment is low because of the small opening of the air shutter due to its adjustment or clogging or because of improper burner design. Yellow tipped flames with oil gas may not be objectionable; that is, combustion characteristics may be satisfactory and sooting will not occur.[18] However, in readjusting, it is best to be on the safe side by eliminating yellow tips whenever possible. Yellow flames should be avoided, especially for pilots, since sooting on pilots may cause automatic pilot failure.

It is interesting to note that several companies have indicated that normal flame adjustment on natural gas was best before conversion to oil gas.

A discussion of complaints occurring on certain types of appliance burners is given by L. J. Willien in his article "Stand-by Gas."[20]

It has been reported that oil gas has a deleterious effect on certain diaphragm materials and hence replacement may be necessary in some cases.

The oil gas which has been indicated as the most satisfactory substitute for natural gas had one special characteristic: a high N_2 content. Inerts, in general, have the tendency to reduce flash-back for oil gases.

A high illuminant content, of course, will tend to lead to yellow tip formation and hence a low illuminant content is desirable.

A high hydrogen or acetylene content will tend to cause noisy extinction and flash-back; hence, a composition low in both constituents is desirable.

A high paraffin content will be desirable since these gases are desired to simulate natural gas.

As the heating value of the oil decreases (800-Btu limit) the methane and H_2 increase and the illuminants decrease.[21] This heating value decrease could be effected by raising the operating temperature or by lowering the make oil rate.

Olefins in illuminants have been shown to decrease with heating value decrease which would tend to indicate that higher cracking temperatures would produce lower-Btu gases that may be more acceptable as natural gas substitute[12]. Decrease of the C_4+ group in the illuminants occurred with decreased cracking or higher heating value.[12] However, this may be dependent on the atmosphere in which cracking occurs since other unpublished data indicate the reverse.

The C_4+ group may contain a high percentage of benzene and/or other aromatics which are the worst offenders from the standpoint of yellow flame formation. Proper oil gas scrubbing operation should be employed which will remove most or all of these objectionable materials.

The degree and extent of cracking of gas oils under various conditions are well taken up by Hugh E. Ferguson.[21]

In general, gases are more interchangeable when input rate to burners remains the same. Accordingly, since input rate is proportional to the factor $\frac{h}{\sqrt{d}}$ this factor should preferably be equal for adjustment gas and substitute gas. Since primary air entrainment is proportional to $\frac{\sqrt{d}}{h}$* or the reciprocal of the above, primary air aspiration should be equal when the factor $\frac{h}{\sqrt{d}}$ are equal for substitute and adjustment gases.

These above facts were employed in both the Knoy Interchangeability index and the first factor of the AGA "C" Interchangeability index. Although use of the factor $\frac{\sqrt{d}}{h}$ does not take into consideration the gas composition, nevertheless it is a quick and easy means for determining whether a gas is likely to be interchangeable for another gas.

Mr. Willien has indicated that the specific gravity and chemical composition of a high-Btu manufactured gas rather than its Btu are the determining factors in the ability to use such a gas as a substitute for natural gas. Also, the best substitute is an oil gas having the same specific gravity as natural gas.[20]

The specific gravity of an oil gas is dependent on its heating value,[18] so that if either is given, the other can be estimated.

It is apparent that for conversion to oil gas, greater primary air entrainment should occur than for natural gas

*Primary air injection is referred to throughout as the amount of primary air injected expressed as a percentage of air theoretically required for complete combustion.

TABLE 3. OPERATIONAL EXPERIENCE

Company No.	1	2	3	4	5	6
Type Nat. gas sendout	1015 Btu 0.68 sp gr	1050 Btu 0.65 sp gr	1025 Btu 0.67 sp gr	1100 Btu 0.64 sp gr	1000 Btu 0.68 sp gr	900 Btu 0.54 sp gr 1100 Btu 0.64 sp gr (Nat. gas-coke oven gas)
Approx. Analysis:						
CH_4	74			88.0	75.0	66.9
C_2H_6	15			7.3	13.3	6.0
N_2	11			1.1	11.4	1.1
Other				3.5	0.3	(CO 1.8 (CO_2 0.5 (Ill. 1.8 (O_2 0.5 (H_2 21.4
Type Oil Gas	950 Btu	995 Btu	1100 Btu 0.73 sp gr	1035 Btu 0.75 sp gr	937 Btu 0.87 sp gr	860-910 Btu up to 0.69 sp gr
Approx. Analysis by Volume:						
CO		1.2		0.5	1.4	1.1
H_2		12.7	14.0	16.1	15.9	14.8
CH_4		34.1	46% (Paraffins)	42.3 (Paraffins)	22.8	41.0
C_2H_6					3.5	1.5
Ill.		28.5	27.0	28.9	27.2	17.9+
CO_2		3.8		1.9	3.5	2.2
O_2		0.9		0.4	1.4	0.9+
N_2		18.8		9.9	24.3	20.6
Max. % oil gas sendout with normal customer reaction	50	100	100	60 - 70	40	40 - 50 of natural gas used
Major difficulties encountered with use of higher than max.% allowable oil gas send-out	none at max.	Very slight pilot difficulties with too rich oil gas. Some burner trouble when adjustment range was too narrow	Yellow tips and leak complaints	Leak complaints, some flash-back and yellow tips @ 100%	Flash-back, noise of extinction, increased leak complaints; increased pilot outage	Odor complaints increased; condensates
Gen. type of flame adjustment on customer appliances		Normal		Normal	soft (?)	Soft except ranges
Normal press. (inches of water) for distribution system				5 to 6	5.5	4 - 6
Variation in press. (inches of water) for distribution system				Max. 2.5-3.0 inches allowable by regulation	negligible variation	worst conditions 3 - 12
Remarks:	Company has not used greater than 50% oil gas since it has been found unnecessary	With heating value of 990 to 1010 Btu, satisfactory conversion occurred	Complaints were received from 1.4% of total customers (18)	Distribution service 3 times normal when 100% oil gas was used for short interval	No scrubbing employed	During peak load the nat. gas-coke oven is mixed with blue gas, carburetted water gas, Hi-Btu oil gas and a small amount of refinery oil gas

as indicated by the fact that primary air for both lifting and yellow tip limit curves are about 20% lower for natural gas than for oil gas. Accordingly, the primary air factor $\frac{\sqrt{d}}{h}$ should preferably be greater for oil gas than for natural gas.

The distribution pressure has been assumed to be constant when conversion occurs, which it normally is. Any increase in pressure will, of course, increase the burner input rate (rate proportional to square root of pressure) and will have to be compensated. Primary air entrainment in general is not changed to any extent with pressure change. Accordingly, the compensation will have to be applied mainly to correct for burner input rate change. As may be noted by *Table 2*, substitution of oil gas for natural gas may cause a slight decrease in burner input rate and hence a slight increase in distribution pressure will be beneficial. Burner input rate change of $\pm 10\%$ and even higher can normally be tolerated without any unsatisfactory burner performance, so that some pressure variation is allowable.

Decrease in input rate will enhance flash-back tendencies and will increase cooking time. Increase in input rate may cause tendencies for flame streaming and lifting.

A quick and easy means of determining interchangeability is through an interpretation of the factors $\frac{h}{\sqrt{d}}$, $\frac{\sqrt{d}}{h}$ "K" and "Y" factors for adjustment and substitute gases. The ignition velocity of the constituent gases in the adjustment and substitute gases, as well as the ignition velocity for the latter two gases, are also important factors to be considered.

These values can be determined or estimated from data available.[14,15] The interchangeability equations for lifting. flash-back and yellow tips may be used if desired by employing the estimated factors "a," "f," "K," and "Y" as obtained from similar gases.

Although it is not in the scope of this article to discuss various interchangeability formulae, it is worthwhile to mention that many others do exist such as Knoy, AGA "C," and Cutler-Hammer indices. Each has found use in the past and although they have limitations, some engineers still employ them to some extent. A good review of the subject of interchangeability of fuel gases is given by Jesse S. Yeaw in *Gaseous Fuels*.[19]

The maximum allowable limit of supplemental gas addition to the base adjustment gas will be determined most reliably when practical, by suitable laboratory tests on a group of representative appliance burners.

The AGA allowable interchangeability index limits for lifting, flash-back and yellow tips are not theoretical values but only empirical values determined through numerous tests on certain appliance burners with a large number of gas mixtures.

It should be emphasized that whenever possible allowable index limits should be chosen which will be consistent with the AGA allowable index limits determined for gases simulating those employed in the particular interchangeability problem being studied.

Conclusions

1. A 960-Btu, 0.74- sp gr oil gas or one similar in composition to this gas may be employed satisfactorily with almost complete substitution for a typical natural gas.

2. Field results also indicate that oil gas with the proper composition can be substituted 100% for natural gas satisfactorily, although complaints greater than normal customer reaction will occur initially upon substitution unless uniform and normal flame adjustments are made for appliance burners on natural gas before conversion takes place.

3. Service calls due to the customers' complaints will require usually only a simple air shutter setting.

4. Difficulties mostly encountered with appliance burners upon converting to oil gas from natural gas are likely to be as follows in decreasing order: Leakage (or order complaint), yellow tips and flash-back.

5. Appliance conversion to oil gas from a natural adjustment gas is inexpensive since the service department of a gas utility should be able to handle needed burner adjustments.

6. Interchangeability problems require experienced interpretation.

7. Some flash-back and yellow tips may both possibly occur simultaneously with oil gas for different burners in the distribution system due to having both too hard and too soft flame adjustments with natural gas. This, of course, will not occur when normal uniform air shutter adjustments exist.

8. Some flash-back and yellow tips may occur on different burners due to improper operation of the oil gas set during the day. With a set too hot, a high H_2 concentration is apt to occur, causing flash-back difficulties. With an operation temperature which is too low (perhaps upon initiating operation), a high illuminant content may result causing yellow tip difficulties.

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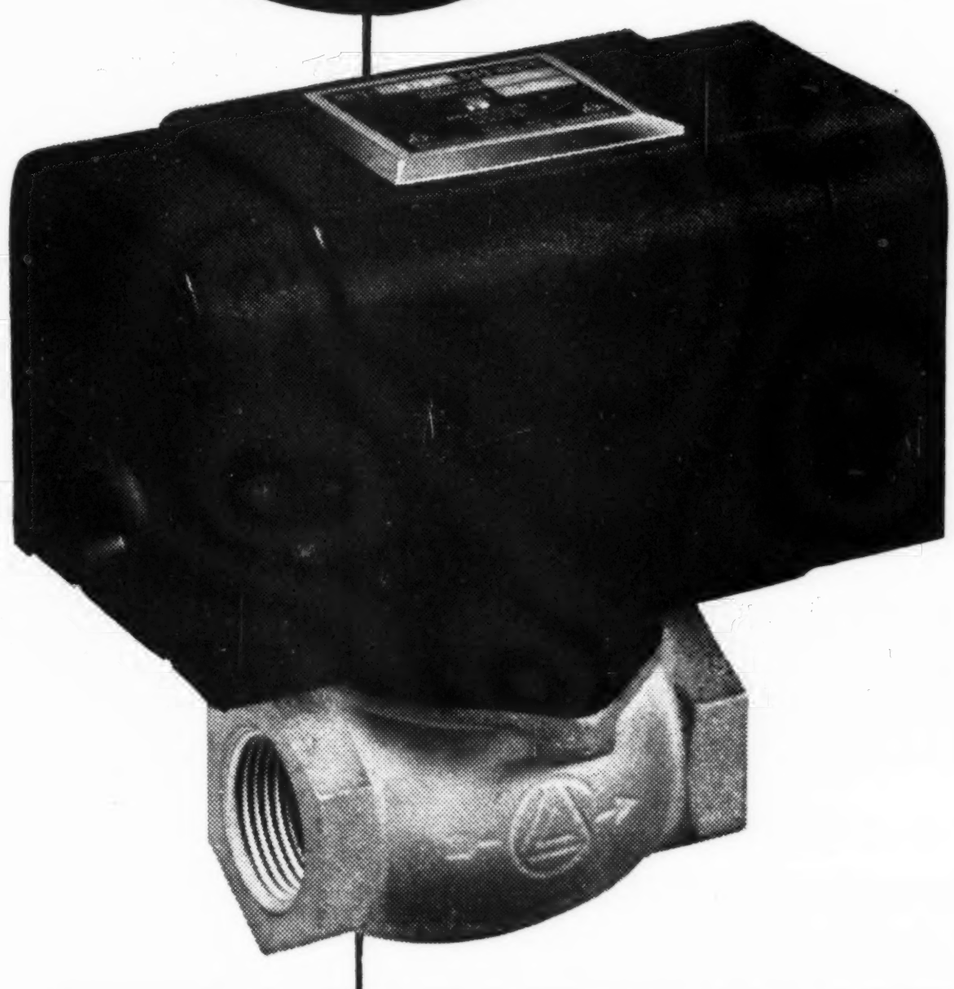

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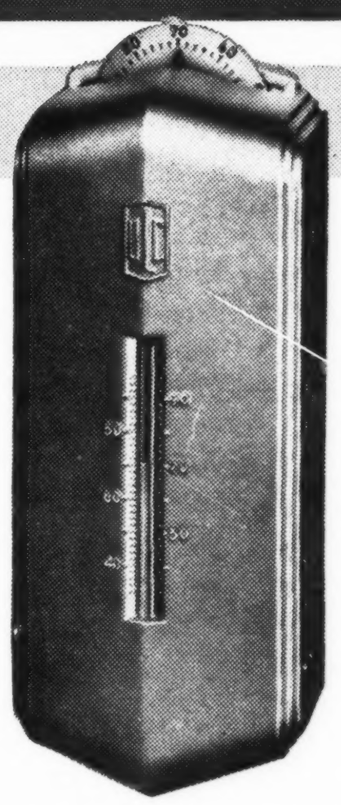

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welcome to Cincinnati

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Nashville bound

Technical Honors

Founder to be feted at distribution conference

More than 600 delegates from technical, distribution, motor vehicle, and chemical divisions of the gas industry are meeting this month—April 4-6—in Cincinnati to mark the 25th anniversary of the founding of the annual conferences and to honor the man who sponsored the first one in Toronto, Can., in June, 1924—Jacob D. von Maur, consulting engineer for Consumers Gas Co., Toronto.

As a tribute to the founder, the meeting has been officially named "The Jacob D. von Maur Silver Anniversary Distribution, Motor Vehicle, and Corrosion Conference." A committee headed by H. Bruce Anderson, The Philadelphia Gas Works Co., has been appointed to receive contributions from distribution men for a gift for Mr. von Maur.

A program so diversified that it cannot be even briefly recited here is in store for delegates. W. R. Fraser, Michigan Consolidated, Detroit, chairman of the technical section of the AGA, headed a four-man committee which drew up the program. Assisting him were J. M. Pickford, Northern Indiana Public Service Co., Hammond, distribution committee chairman; F. M. Rudman, Michigan Consolidated, motor vehicles committee head; and Sidney E. Trouard, New Orleans (La.) Public Service, corrosion committee chairman.

Luncheon conferences covering each of the four phases of the conference will be held each day, with experts in each of the fields acting as moderators. A wide variety of subjects, ranging from construction and maintenance, meters and metering, distribution design and development, work on consumers' problems through motor vehicles and corrosion problems, will be discussed.

W. C. Beckjord, Cincinnati Gas & Electric president, will welcome delegates.

Safety and standardization methods will be topics aired at the general session on Tuesday, while on Wednesday, the morning period will be devoted to distribution problems—at the General Session—with motor vehicle and servicing matters under discussion at morning and afternoon conferences.

ASSOCIATIONS

GAMA in Rockies

GAMA has succumbed to the lure of the gayer life, and will give its members an opportunity to mix a larger portion of pleasure with business when it holds its annual meeting this month.

Delegates will likely pack their golf bags along with brief cases when they take off for Colorado Springs, locale of the meeting to be held April 4-7. At last, it would seem, the after-effects of wartime sobriety are beginning to wear off, and the manufacturers are going to take a leaf from the books of brother organizations who have already trended from the big city hotels, and found the move to their liking.

And perhaps the well-advertised charms of the Rockies are proving their drawing power, as, according to headquarters, early reservations for this session exceeded final registrations for any previous meeting.

The program, too, holds strong attractions: it promises to be top-notch. With manufacturers once more on the well-known threshold, this time of an uncertain, changing market, they will want to hear expert opinions and interpretations of the current business scene from men in a position to know. Familiar names in the industry dot the program; from them members will get a glimpse of the state of the trade nationally, the outlook for the rest of 1949, and—still uppermost in the minds of many—the continuing problem of selling in a buyer's market.

GAMA's 12 divisions will hold individual sessions which promise to get down to cases on many of the problems needing solution. Augmenting these programs will be the combination lunches and general sessions, providing the total membership an opportunity of gathering together, and evening dinners. Divisional sessions are scheduled for mornings only, leaving afternoons free for recreation or continuation of morning discussions where extra time is needed.

General session headliners include Robert W. Hendee, president of the AGA and of the Colorado Interstate Gas Co., who will be right at home at the Broadmoor hotel; Frank C. Smith, PAR expert; Frank J. Nugent, GAMA leader; George Richards, legal counsel; Charles C. Warwick, traffic committee chairman; R. T. Killian, marketing committee head; and Dr. John L. Davis, humorist.

Divisional subjects will include these, among others:

House heating sales restrictions, range campaigns, valve requirements, incinerator promotion, meter freight problems, heating division marketing program, CP dealer promotion plans, controls in the LP-Gas market, clothes dryer promotion, gas boiler problems, Court of Flame, furnace requirements, and conversion burner requirements.

A special feature will be the presentation of meritorious service awards to members in recognition of outstanding services to the industry.

Industrial-Commercial

Industrial and commercial gas men have brushed up on their Southern accents and entrained for Nashville, Tenn., where the annual AGA sales conference is taking place April 5-7. It will mark the first time in many years that the conference has ventured that far south of the Mason-Dixon line.

The three-day conference will be held at the Andrew Jackson hotel, and will be split into a "commercial gas day" April 5, an "industrial gas day" April 7, and a joint general session on the morning of the 6th. That aft-

ernoon, concurrent symposia will be held.

B. T. Frank and D. W. Reeves, sectional chairman and vice chairman, will preside.

These important topics are on the first-day program:

Subjects of the afternoon industrial gas symposia:

"High Speed Heating," by C. C. Eeles, Ohio Fuel Gas, Toledo; C. H. Lekberg, Northern Indiana Public Service Co., Hammond; and James Kniveton, Selas, Philadelphia.

"Galvanizing by Gas," with E. B. Freeman, Central Indiana Gas Co., Muncie; Paul R. Dryer, Peoples, Chicago; and E. J. Funk, Kemp Manufacturing, Baltimore.

Commercial symposia agenda:

"Servicing—Southern Style," by Terry Hart, Nashville Gas & Heating Co.; O. C. Warren, Alabama Gas Corp., Birmingham; and K. O. Dupree, American Stove Co., Atlanta.

"Selling is Still Important," featuring James V. Hall, Northern Indiana Public Service; E. V. Fineran, Washington (D.C.) Gas Light Co.; J. R. Delaney, Cincinnati Gas & Electric; J. D. Haverkamp, New Orleans Public Service.

Industrial gas day subjects include:

"Protective Devices," by A. G. Segeler, AGA.

"Radiant Gas Burners," by J. D. Keller, Associated Engineers, Pittsburgh.

"Gas Atmospheres in the Paint, Varnish, and Chemical Industries," by W. F. Barston, Gas Atmospheres, Inc., Cleveland.

"Speeding Up Production in the Textile and Paper Industries," by G. R. Van Kampen, Red-Ray Manufacturing, New York.

"The Surge Method of Paint Drying," by an R. C. Mahon Co. representative.

"Simplified Sizing for Restaurant Water Heaters for Dishwashers"; a solution to this much-studied problem will be presented by J. S. Setchell of AGA.

"Developments in Storageless Water Heating," a joint paper of Harry B. Wilson, Brooklyn Union Gas Co., and E. E. Magnuson, Eclipse Engineering Co., Rockford, Ill.

"Report on Investigation of Gas and Electric Commercial Kitchens," by Frank H. Trembly, Philadelphia Gas Works, AGA subcommittee head.

"Diversified Commercial Sales," a symposium on lesser volume, load factor-building uses, including air conditioning, laundries, garages, bottling plants, tailor shops, apartment house water heating, dairies, and rug drying.

"Modern Gas Ovens for the Retail Bake Shop," by J. E. Coan, Middleby-Marshall Oven Co.

Labor Relations Aired

The philosophy behind current considerations on federal labor relations was explored in a review headed by D. W. Swarr, Omaha labor counsellor, which featured the AGA Midwest Personnel Conference, held in Omaha on March 2.

In another top-interest report, Richard L. Matheson, safety engineer for Panhandle Eastern Pipe Line Co., described the comprehensive accident prevention program of his company as a beginning for proposed activity of the conference in this field.

Chairman of the conference was H. H. Duff, Panhandle Eastern personnel director.

Here's where delegates to the Canadian Gas Assn.'s 1949 annual convention will meet June 16-20. It's Bigwin Inn, located on Bigwin Island, Lake of Bays, Ontario. An attendance of 400 members and guests is anticipated.

Busy Days Ahead in Dixie

Southern Gas Assn. plans strenuous schedule for 41st annual convention at gulf resort

"It's full speed ahead for the good ship 'Southern Gas'—at Biloxi on April 20, 21, and 22."

That's the official chant of the Southern Gas Assn. as it prepares for its 41st annual convention scheduled for this month at the popular Mississippi gulf resort.

As usual, the soft-spoken but aggressive gasmen have put together an ambitious program that will keep the more conscientious members jumping. Here are the inklings of the agenda's scope:

Three general sessions are tabbed for Thursday morning, Friday morning and Friday noon—April 21 and 22.

Two afternoon sessions are programmed for the accounting section.

The sales section will meet Wednesday morning, April 20, Wednesday noon, Wednesday afternoon, Thursday noon, and Thursday afternoon.

The operating section will gather Wednesday morning, Wednesday afternoon, Thursday noon, and Thursday afternoon.

Specific subjects that will get a thorough going over include PAR, the well-publicized AGA promotion, advertising, and research plan; accounting decentralization, job evaluation, internal auditing, effects of changing price levels on gas utilities; home service problems, which will be delineated in a "home service workshop," a part of the sales section's program; range ignition—with emphasis on single point ignition, dealer cooperation, commercial cooking equipment, a report on competitive commercial cooking tests, industrial and commercial air conditioning, and the Court of Flame water heater promotion.

The operating section will debate accident prevention and corrosion, and will hear talks on cathodic protection, right of way problems, removal of condensible vapors, training dealer servicemen, cleaning mains, training and selecting drivers.

President Wister H. Ligon, Nashville (Tenn.) Gas & Heating Co., and L. L. Baxter, Arkansas Western Gas Co., Fayetteville, will preside.

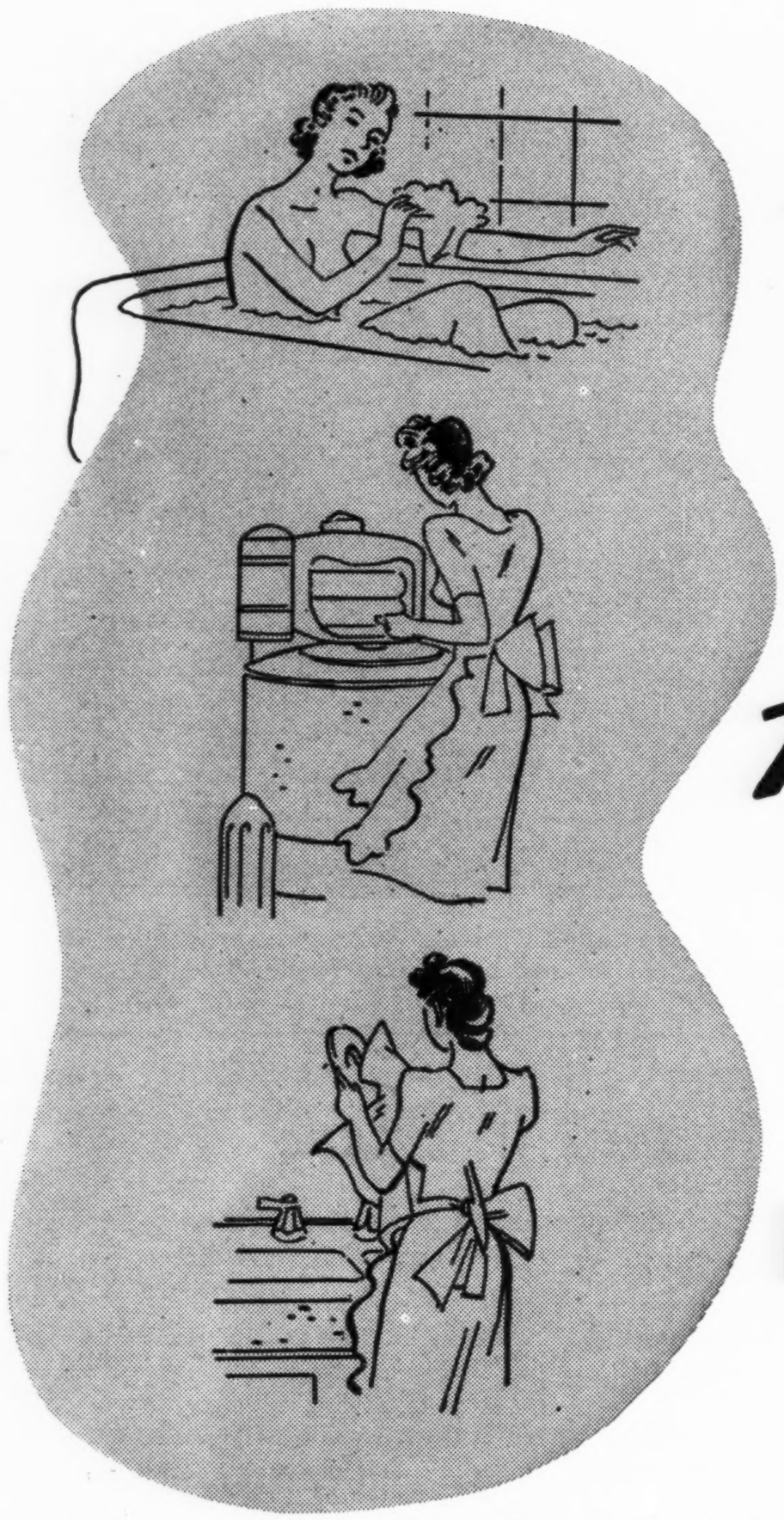
R. A. Puryear, vice president, Alabama Gas Co., headed the committee which lined up the program. Sectional chairmen included J. M. Lynn, Lone Star Gas Co., Dallas; J. H. Collins, New Orleans Public Service Co.; and J. H. Cookenboo, Houston Natural Gas.

Thirteen states from Virginia to New Mexico will be represented at the meeting.

PCGA at Home Show

Gas will take its place among the top attractions at the fourth annual Construction Industries Exposition and Home Show, to be held June 2 to 12 at the Pan-Pacific auditorium in Los Angeles. One of an impressive group of sponsoring organizations is the Pacific Coast Gas Assn.

The gas and allied industries' heating, air conditioning, and kitchen layouts promise to receive more than passing attention from the 100,000 persons expected to attend. Last year's show drew over 125,000, more than 20,000 of whom were contractors and builders. Heavy building activity in the area should act as a spur to send total attendance at the 1949 exposition to another record figure.



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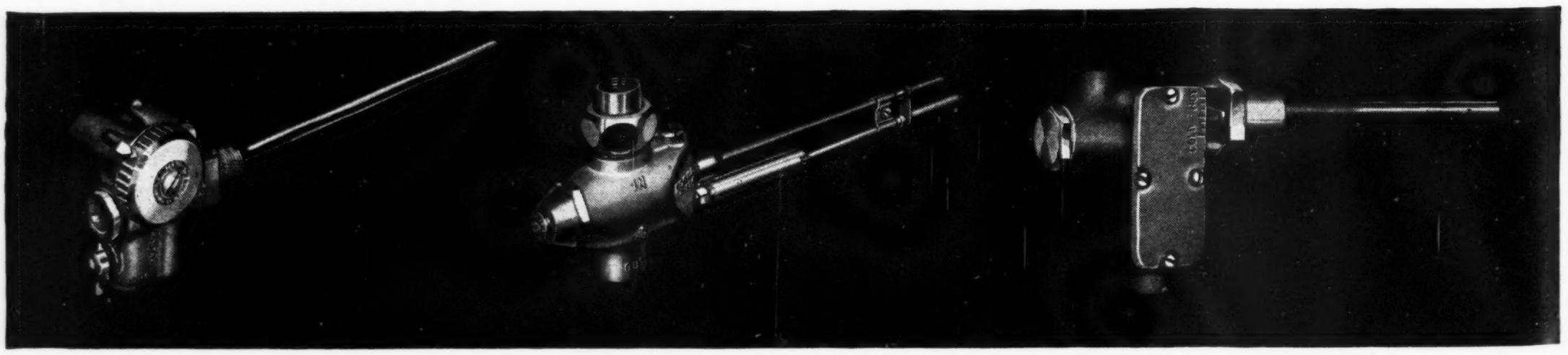
This year will be no exception. Hundreds of thousands of Automatic Hot Water Heaters will be installed in both old and new houses. Naturally you want your customers to enjoy trouble-free operation of this new equipment so we urge — EQUIP YOUR AUTOMATIC HOT WATER HEATERS WITH—

TITAN
WATER HEATER CONTROLS

May we suggest that you place orders as far in advance as possible to assure deliveries according to schedule.

THE TITAN VALVE & MANUFACTURING COMPANY
9913 ELK AVENUE **CLEVELAND 8, OHIO**



PLANNERS of the Southwestern Gas Measurement Short Course, being held this month at the University of Oklahoma, left to right: M. D. Gilbert, Rockwell, Tulsa; J. W. Sanders, Arkansas Oil and Gas Commission; E. L. Stark, Foxboro, Dallas; J. L. Griffin, Northern Natural, Omaha; T. S. Whitis, Amarillo (Texas) Oil; Kate A. Niblack, Oklahoma Utilities Assn.; C. F. Terrell, Southern Natural, Birmingham; W. H. Carson, university; W. A. Brewster, Ark.-La. Gas, Shreveport; W. H. Woods, Gulf Oil, Houston; B. F. Worley, United Gas Corp., Shreveport; G. E. Greiner, Phillips Petroleum; Earl Kightlinger, Ark.-La. Gas, Shreveport; Dean Bruce, Oklahoma Natural, Tulsa.

Measurement Class

Plans for an expanded 1949 Southwestern Gas Measurement Short Course, to be held at the University of Oklahoma at Norman, were made at a meeting of the general committee in Oklahoma City, recently.

W. H. Woods, Houston, chairman of the program committee, announced at the meeting that 68 specialized classes will be held dealing with subjects sufficiently diversified to cover all phases of gas measurement and regulation. Mr. Woods also announced that C. T. Chenery, chairman of the board, Southern Natural Gas Co., Birmingham, Ala., will deliver the principal address.

As in former years, the morning sessions during the three days of the short course, April 12-14, will be devoted to general subjects and the afternoons to specialized classes. Management of the short course expects the enrollment to exceed the 849 registered last year.

Manufacturers of gas measurement and regulating equipment will continue their cooperation through exhibits, demonstrations, and classroom instruction. W. A. Brewster, chairman of the exhibits committee, announced that 30 manufacturers will have displays.

Chairman G. E. Greiner, Bartlesville, Okla., of the Committee for Study of Practical Methods, will have available for distribution at the school a pamphlet entitled, "Condensed Outline of Supercompressibility Determination Methods."

Personnel Study

Forty personnel executives of gas companies in the area met for the AGA Southwest Personnel Conference meeting on Feb. 28 in the Hotel Peabody, Memphis, Tenn. Pertinent observations on human relations in industry and a plea for increased attention to supervisory training were made in a paper presented by AGA Secretary Kurwin R. Boyes.

M. V. Cousins, director of personnel, United Gas Pipe Line Co., reported on the Advance Management Program, a 13-week course conducted by the Harvard Graduate School of Business Administration. H. V. Luneborg, Arkansas Natural, conference chairman, described the second annual survey of fringe benefit costs which will be made by the national personnel committee. A discussion on specific problems facing companies including such subjects as basis for rental and allotment of company houses, contract negotiations and cost of living bonuses followed.

A questionnaire on personnel policies to be sent to the companies represented in the conference was submitted by Harold F. Taylor, Oklahoma Natural Gas Co.

By formal vote, the conference officially became affiliated with the Southern Gas Assn.

Appliance School

The 1949 Short Course in Gas Appliances will be held June 1-3 at the University of Tulsa, Tulsa, Okla.

Instead of having two courses, conducted separately on consecutive dates, as in former years, the College of Petroleum Sciences and Engineering, which offers the course and furnishes its facilities for the classes and the Southern Gas Association, sponsor, announce that the two courses will be combined. Special technical sessions will be offered each day for the natural gas and liquefied petroleum gas divisions.

Each registrant who attends all of the sessions in his division will be awarded a certificate of completion to certify that he has completed an 18-hour course in the servicing and installation of gas appliances.

Subjects to be presented in the general sessions include: "From Well to Burner" (a film); "Oklahoma Natural Gas Co. Operations" (film); "It's Your Industry," and "What's New in the Future of the Gas Industry."

Subjects to be included in the natural gas technical sessions will be:

"Automatic Controls," a three-part presentation on the installation and servicing of thermostats, magnetic valves, relays and limit controls, and diaphragm and valve controls, including appliance regulators.

"Service Manuals as an Aid to the Service Man."

"Burner Conversion."

"Correct Tools and Their Uses."

"Commercial and Small Industrial Burners."

"Floor Furnaces."

"Gas Refrigeration."

"Regulators."

"Water Heaters."

"Service of Gas Ranges."

"Service Supervisors Round Table."

A banquet is scheduled for Friday. The meter shop of the Oklahoma Natural Gas Co. in Tulsa will be open for inspection during one night of the course.

NACE Annual Meet

The National Assn. of Corrosion Engineers will hold its annual conference April 11-14 in Cincinnati, Ohio. Speakers and titles of most of the 42 technical papers to be presented have been established for the four-day conference.

The papers will be presented at 11 symposia:

April 11—Symposium on Corrosion Principles.

April 12—Chemical Industry Symposium
Electrical and Communications Industries Symposium.

April 13—Cathodic Protection Symposium
Pulp and Paper Industry Symposium
General Industry Symposium
Transportation Industry Symposium

April 14—Protective Coatings Symposium
Oil Industry Symposium
Salt Water Corrosion Symposium
Gas Industry Symposium.

Announcement of the program came from Dr. N. E. Berry, Servel Inc., chairman of the technical program committee. Only minor changes in the program may be expected now, according to A. B. Campbell, NACE executive secretary.

LP-Gas in Canada

The first real annual meeting of Chapter 8, Canadian section, LP-Gas Assn., since its organization a year ago, was held in Toronto, Feb. 14-15, with almost a record attendance from many parts of Canada and the United States.

M. E. McLean, president of the National Propane Co., Ltd., of Hamilton, Ont., presided as chairman of the convention, and was again elected to carry on while the organization is still in its formative stage.

The program itself covered such items as: The steel situation, especially in relation to

Calendar

April

Industrial Accident Prevention Assn. Convention—Royal York hotel, Toronto, April 4-5.

Distribution, Motor Vehicle & Corrosion Conference—Netherlands Plaza hotel, Cincinnati, April 4-6.

Gas Appliance Manufacturers Assn. Annual Meeting—Broadmoor hotel, Colorado Springs, April 5-7.

AGA Sales Conference on Industrial and Commercial Gas—Andrew Jackson hotel, Nashville, April 5-7.

Gas Meters Assn. of Florida-Georgia Annual Meeting—Ponce de Leon hotel, St. Augustine, Fla., April 10-12.

Mid-West Gas Assn. Annual Convention — Hotel Fort Des Moines, Des Moines, Iowa, April 11-13.

National Assn. of Corrosion Engineers — Netherlands-Plaza hotel, Cincinnati, April 11-14.

AGA-EEI Spring Accounting Conference — Hotel Book - Cadillac, Detroit, Mich., April 11-13.

Western Metals Congress & Exposition — Shrine Convention hall, Los Angeles, April 11-15.

Southwestern Gas Measurement Short Course — University of Oklahoma, April 12-14.

Midwest Power Conference—Hotel Sherman, Chicago, Ill., April 18-20.

Southern Gas Assn. Annual Convention—Buena Vista hotel, Biloxi, Miss., April 20-22.

The Maryland Utilities Assn. Annual Meeting—Lord Baltimore hotel, Baltimore, April 22.

Indiana Gas Assn. Convention—French Lick Springs hotel, French Lick, Ind., April 28-29.

May

AGA Natural Gas Department Spring Meeting — French Lick Springs, Ind., May 9-10.

Interstate Oil Compact Commission Spring Meeting—Jacksonville, Fla., May 9-11.

LPGA Annual Convention—Palmer House, Chicago, May 9-11.

AGA Industrial Gas School—Hotel Severin, Indianapolis, Ind., May 9-13.

AGA Executive Conference—Netherlands Plaza hotel, Cincinnati, May 12-13.

National Fire Protection Assn.—Fairmont hotel, San Francisco, May 16-19.

Pennsylvania Gas Assn. Annual Convention—Galen Hall, Wernersville, May 17-19.

New Jersey Utilities Assn. Spring Meeting — Seaview Country Club, Absecon, N. J., May 20.

AGA Production & Chemical Conference — Hotel New Yorker, New York, N. Y., May 23-25.

National Restaurant Exposition—Atlantic City, N. J., May 24-27.

Pacific Coast Domestic Research and Utilization Conference — Ambassador hotel, Los Angeles, May 26-27.

The Natural Gas & Petroleum Assn. of Canada Annual Meeting—Hotel London, London, Ont., May 26-27.

Fourth Annual Short Course in Gas Technology—Texas College of Arts & Industries, Kingsville, May 30-June 1.

National Assn. of Master Plumbers—Annual Convention & Home Comfort Exposition, Cleveland Public auditorium, Cleveland, Ohio, May 30-June 2.

June

Canadian Gas Assn. Annual Convention—Bigwin Inn, Lake of Bays, Ontario, June 16-20.

New York-New Jersey Regional Gas Sales Conference — Essex & Sussex hotel, Spring Lake, N. Y., June 20-21.

Michigan Gas Assn. Annual Convention — Grand hotel, Mackinac Island, Mich., June 24-25.

August

National Assn. of Railroad & Utilities Commissioners — Hotel Cleveland, Cleveland, Ohio, Aug. 7.

September

Pacific Coast Gas Assn. Annual Convention—Santa Barbara, Calif., Sept. 7-9.

New Jersey Gas Assn. — Monmouth hotel, Spring Lake, N. J., Sept. 9.

The Maryland Utilities Assn. Fall Conference—Cavalier hotel, Virginia Beach, Va., Sept. 16-17.

National Butane-Propane Assn.—Jefferson hotel, St. Louis, Sept. 19-21.

October

Texas Mid-Continent Oil & Gas Assn. Annual Meeting—Rice hotel, Houston, Oct. 13-14.

American Gas Assn. Annual Convention—Chicago, Oct. 17-20.

National Safety Congress—Morrison hotel, Chicago, Oct. 24-28.

the production of LP-Gas containers; the LP-Gas appliance situation and the need of more ranges, water heaters, etc.; and the need for a Canadian servicemen's training center, to be located in Montreal, or some other suitable Canadian city.

Liquefied petroleum men from as far west as Calgary, Alberta, and as far east as New Brunswick, were in attendance.

Gas on Display

Grain structures, tensile and impact properties and other characteristics of alloy steels achieved through heat treatment with gas will have heavy emphasis at the Western Metal Congress and Exposition, April 11-15 in Shrine Convention Hall, Los Angeles.

One paper of particular interest to gasmen will be delivered by G. B. Berlien, Industrial Steel Treating Co., Oakland, who will talk on "New Wrinkles in Heat Treating."

George A. Sherman, California State Division of Industrial Safety, San Francisco, is programmed by the American Welding Society for the same afternoon to discuss the proposed code for handling of hazardous objects. Following his paper, another speaker from his office, as yet unnamed, will describe precautions to be taken in handling and using liquified petroleum gases, propane and butane.

Several speakers on the ASM technical sessions are programmed to describe developments in application of gases to prevent oxidation during heat treatment of the more volatile metals.

Gas-consuming heat treatment furnaces will operate daily at the exposition, and heat treating control instruments will be put through their paces, says W. H. Eisenman, national secretary, ASM, in charge.

Exhibitors include American Gas Furnace Co., Brown Instrument Co., Bryant Heater Co., Eclipse Fuel Engineering Co., James H. Knapp Co., Natural Gas Equipment Inc., Pacific Scientific Co., and many others.

The Pacific Coast Gas Assn. and Western Oil and Gas Assn. are among approximately 18 technical societies cooperating in the meetings and show.

Field Research Meet

Gasmen interested in petroleum research and not already committed to another of the numerous conventions scheduled for the first part of this month will head for Texas A. & M. College at College Station April 6 for a three-day conference. The meeting is being sponsored by the Texas Petroleum Research Committee.

These treats and treatises — and many others—are in store:

Railroad Commission Chairman W. J. Murray Jr.: "The Commission's Function in Increasing Oil Recovery."

Dr. George H. Fancher: "Theoretical Considerations in Secondary Recovery."

Martin Miller and Max Lentz: "Practical Aspects of Gas Cycling."

Paul D. Torrey: "A Review of Secondary Recovery in the United States."

A. B. Stevens, professor of petroleum engineering at the college, is in charge.

EXPANSION

Texas Eastern

75 MMcf capacity boost receives FPC okay

In late February the FPC put the final okay on Texas Eastern Transmission Corp.'s construction of additional compressor station horsepower and pipeline which will boost capacity of the company's Big and Little Inch lines by 75 MMcf per day. Company estimates give the new capacity figure as 508 MMcf daily, with the added flow being made possible by 86,150 more horsepower on the Inch lines and about 75 miles of feeder lines to sources of supply in Louisiana and Texas.

The commission's order put the kibosh on Texas Eastern's proposal to sell all the augmenting supplies of natural gas to three of its present customers: East Ohio Gas Co., Peoples Natural Gas Co., and New York State Natural Gas Corp. (the "Consolidated" companies). Instead, the company was ordered to make the supplies available on a basis of need to nine companies which have been seeking gas from Texas Eastern, with the balance, approximately 25 MMcf daily, going to the Consolidated group.

Here's how the new supplies will be rationed:

United Natural Gas Co. of Oil City, Pa., will receive up to an additional 15 MMcf daily. United has been a steady customer of Texas Eastern's; besides servicing its own system it sells wholesale to Iroquois Gas Corp. of Buffalo, N. Y., and Pennsylvania Gas Co. of Erie, both being affiliates. United has a purchase contract with its supplier which calls for deliveries up to a maximum of 30 MMcf daily. In authorizing this one facet of the decision, the FPC made special mention of the fact that United and its two affiliates have been subjected to severe shortages during recent winters.

Associated Natural Gas Co., Tulsa, Okla., will receive deliveries up to 3 MMcf per day. This new company proposes to serve 12 communities in southeast Missouri which are close to Texas Eastern's lines and do not now have natural gas service.

Texas Gas Transmission Co. will receive up to 10 MMcf per day. Half of that allotment goes to Indiana Gas and Water Co., to meet demands of its customers on its pipelines north of Mitchell, Ind. On March 4 in an initial decision, the FPC authorized Texas Gas to construct 7½ miles of 8-in. pipeline which would hook up Indiana's line at Mitchell to the Inch line. When an equivalent supply of gas becomes available to Texas Gas from other sources, the Consolidated companies are to get this volume.

Up to 4 MMcf daily will go to the New York & Richmond Gas Co., which serves Staten Island, N. Y. This is on condition that N. Y. & Richmond is released from its obligation to purchase gas from Trans-Continental Gas Pipe Line Corp., which has its 1840-mile Gulf Coast to New York City pipeline underway.

Five New Jersey utilities will each get a share: Public Service Electric and Gas Co. of Newark, up to 4.5 MMcf daily; Jersey Central Power and Light Co. of Asbury Park, up to 5 MMcf; South Jersey Gas Co. of Atlantic City, the same; County Gas Co. (serving Monmouth and Middlesex counties), up to 3 MMcf; and City Gas Co. of New Jersey (customers in Hunterdon and Mercer counties), up to ½ MMcf daily.

Peoples Natural Gas Co. will apply to the FPC for a rehearing on the allocation to the Consolidated companies. Peoples and its affiliates are seeking to regain 50 MMcf a day which Texas Eastern was under contract to supply.

Under the commission ruling, Peoples and its affiliates would receive only 25 MMcf of an optioned 75 MMcf which was specified in a contract executed in March, 1947, between Texas Eastern, Peoples, and its affiliated companies. Peoples contends that the commission has exceeded its authority under the law in setting aside a firm contract.

In a separate statement, Commissioner Leland Olds (who concurred with the FPC's decision) gave a word of warning to the Jersey companies. He said, in part: "the New Jersey companies now receiving natural gas for the first time should not rely upon the service herein authorized as a first step toward a changeover to all natural gas service. . . . On the contrary, they should plan for an efficient and economical combined natural gas and manufactured gas service, with manufactured gas plant consistently maintained and modernized to assist the interstate pipeline in carrying the expanding load, particularly in winter . . . future requests for shares of additional pipeline deliveries . . . should be considered by the commission in the light of the extent to which distributors have developed manufactured gas facilities and, where available, underground storage to assist in carrying the growing peak loads."

The commission's order left unsatisfied the Revere Natural Gas Co. of Jefferson, Pa., and Tom J. McGrath. Revere had applied for an order directing Texas Eastern to serve it; the application was denied. Mr. McGrath represented coal and railroad interests at the hearing, and stated that Texas Eastern (as well as Texas Gas) didn't have sufficient proven reserves under contract to insure essential requirements of the customers to be served by the new supplies. The FPC heard his brief.

Curtailments Easing?

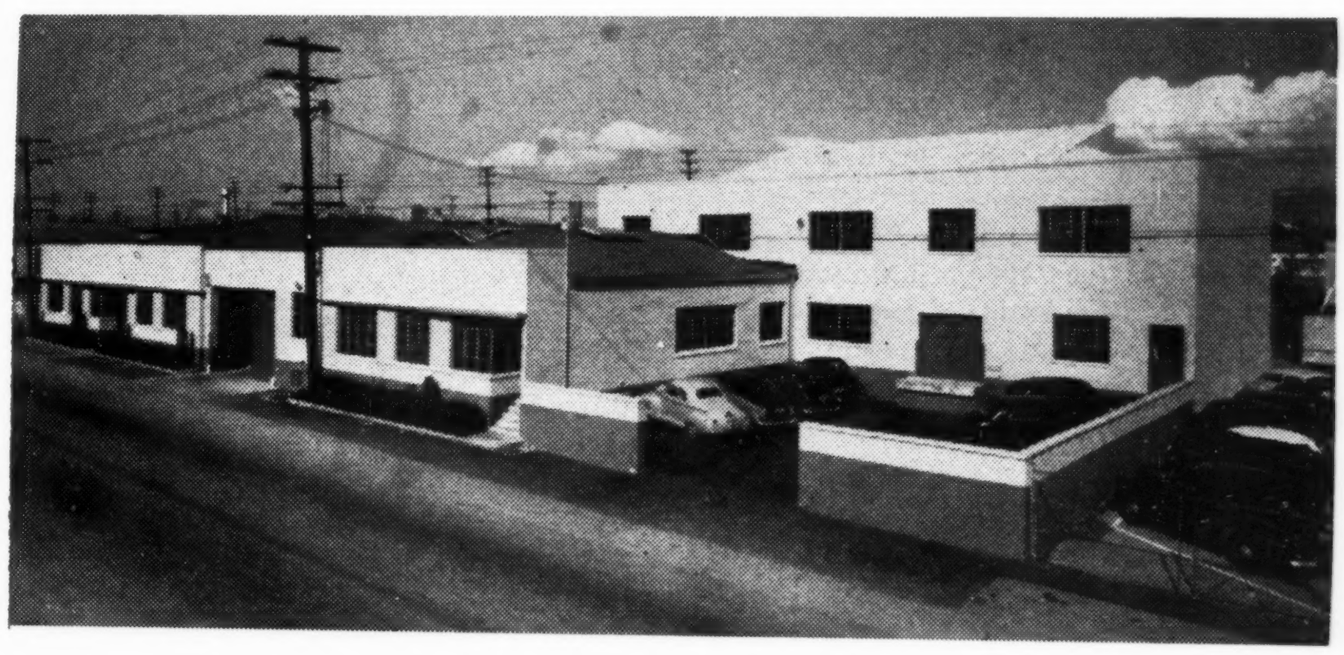
The curtailment dam appears to be breaking. From all over the U. S. reports are coming in of companies advertising that new applications for space heating will be accepted. In the last six weeks . . .

Manufacturers Light & Heat Co., Pittsburgh, Pa., and its associated companies have announced that approval has been given to more than 6500 applications for permits to install gas-fired units in residences scattered throughout Pennsylvania, Ohio and Maryland. The gas company is continuing to receive applications for gas house heating. Approval on these applications received after March 1 must await a continued improvement in gas supply, it was announced.

"Generally mild winter weather," a gas company spokesman pointed out, "is largely responsible for our being able to grant these thousands of requests. Then too, we have been able to complete many construction projects which were undertaken so we could maintain better gas pressures in winter weather."

The Peoples Natural Gas Co., Pittsburgh, Pa., has been able to extend gas heating to almost 5000 prospective customers whose applications have been on file and expects to serve "a substantial additional number" of homes next winter. That was revealed after the firm advised its almost 200,000 domestic consumers that they should get their applications on file if interested in installing central gas heating units.

Company officials pointed out that new applications must be serviced in accordance



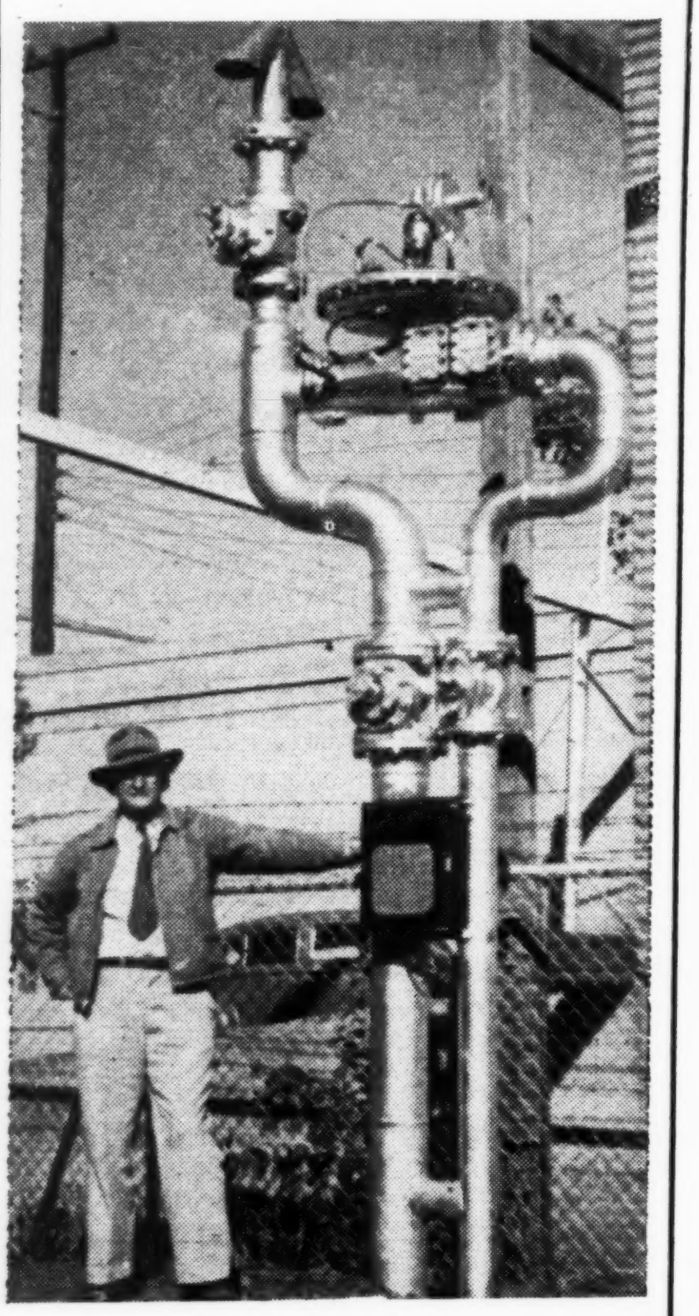
ARCCO LIQUID AND GAS RECORDING gravitometers, gas balances, meters, and chart pens are produced here by the American Recording Chart Co., which recently expanded its Los Angeles facilities. Laboratory and manufacturing departments of the company now have more than 23,000 sq ft of floor space.

The building is completely air conditioned and holds a number of specially-equipped rooms where humidity is maintained at the exact levels necessary to insure precision work. One section of the new plant houses the manufacture and testing of the Arcco-Anubis recording controlling liquid gravitometer.

with the priorities established during the industrial gas crisis last winter. Under that system service is given first to medical hardship cases, next to new houses designed for gas heating, then to those replacing present gas heating units, and finally to those converting from coal.

Cincinnati Gas & Electric Co. reminded its employees through its newspaper that they could join the throngs clamoring for enough gas for space-heating.

The company warned that with the exception of medical hardship cases it was going to be a case of first come, first served, and said that those interested in installing gas heating appliances should get down to company headquarters immediately.



Special Service

The above 4-in. Reynolds regulator installed recently on Lone Star Gas Co.'s Sherman, Texas, distribution system is one of eight of this type being used by this company. Mounted on top of the main regulator is an ordinary service regulator and the entire installation is a combination pressure-loaded and spring-loaded device designed to maintain constant pressure and delivery volume under varying load conditions on a low pressure system. It has a 4-in. intermediate pressure inlet with a 6-in. outlet feeding into an 8-in. low pressure main. The regulator, which requires no housing, was designed by W. H. Ochterbeck, assistant chief distribution engineer, and was built by Robert E. Reading, general division field engineer, assisted by B. O. Pugh, Sherman plant superintendent, shown in the picture.

Home Gas Co., Albany, N. Y., has asked the New York Public Service Commission to ease its ban prohibiting utilities from increasing the number of customers using natural gas for home-heating as the company estimated supplies for next winter will be sufficient to supply demand.

Rosslyn Gas Co., Arlington, Va., has received approval from the state corporation commission on its request that restrictions on the use of gas to replace other fuels for space heating be removed.

Rochester (N.Y.) Gas & Electric Co.'s Edgar R. Crofts, vice president, said, "We'll be able to take care of some extra applications," when he was notified of the FPC allocation of 25 MMcf per day of additional natural gas to the three Consolidated companies, one of which serves Rochester.

The state public service commission has a ban on new gas heating installation in RG&E territory and the company, aided by the city, has been waging a two-front war for the last three months.

Washington (D.C.) Gas Light Co. has received an okay from the public utilities commission on its application asking that the ban limiting the use of gas for home heating be lifted. The year-old emergency order was so amended. Only new construction and homes occupied by invalids had been exempt from the order.

As Washington asked that it be kept informed of additional gas-heating installations the commission's order added that replacement and supplemental gas-heating units "shall be registered with the company within five days after such installation."

The City of St. Petersburg, Fla., Division of Gas, had the following half page ad in the two local papers:

The Gas Situation

"During the past two weeks there has appeared a glimmer of hope that an easing of the pipe supply market is beginning. . . . So, you folks who have been patiently looking forward to perfect cooking with the perfect fuel are urged to make your applications. You will find the gas refrigerator satisfying and silent; the gas water heater gives quick recovery after a heavy use of hot water.

"Gas appliances of superior quality are now available. Outmoded and inefficient appliances should be replaced with up-to-date types equipped with automatic controls. You will find that the resulting economy and the effective use of gas will more than pay for modern appliances during their lifetime."

ConEd to Build

An $8¼ million pipeline construction job in the New York metropolitan area is planned by Consolidated Edison Co. of New York in connection with its future receipt of gas from Trans-Continental Gas Pipe Line Corp.'s Texas-to-New York line. ConEd has asked that the FPC declare that ConEd is not subject to the FPC's authority (as a local distribution firm) or, in the event of a contrary ruling, to authorize construction of the proposed 23 miles of pipeline facilities.

ConEd expects to take 100 MMcf daily from Trans-Continental for its own use, and to take similar volumes for distribution to Brooklyn Union Gas Co., Brooklyn Borough Gas Co., Kings County Lighting Co., and Long Island Lighting Co. ConEd says it has entered into a construction agreement with these companies and will deliver gas to them from Trans-Continental's New York City 132nd St. terminus.

And across the river from ConEd, in New Jersey, the good burghers of Elizabeth are getting worried about the part of the 1840-mile line which passes through their town. To quote the respectable *New York Times,* "Fears have been expressed that the big natural gas line might constitute a fire hazard."

Adding to their worries, it has been publicly announced that the line has the right of eminent domain under the Natural Gas Act. City Engineer Thomas E. Collins has made protest to the FPC; both the commission and ConEd have told Mr. Collins that the line's location would be established only with city officials' approval.

Cities Service Wants HP

Authorization of additional compressor facilities totaling 4790 hp on the Cities Service (Oklahoma City, Okla.) Gas Co.'s Hugoton gas field-Kansas City, Mo. pipeline has been asked of the FPC. Cost of the additional horsepower has been estimated at approximately $1¼ million. The 400-mile line is partially completed.

Cities Service's application also asked for permission to abandon its Hutchinson, Kan., compressor station, stating that the Hugoton-Kansas City line which is now completed to Newton, Kan., provides a sufficient supply of high pressure gas to meet demands in the Hutchinson area. The entire application was said to be part of a 4-year program for expanding compressor facilities as originally applied for in 1946, when the FPC was asked by Cities Service to authorize the Hugoton-Kansas City line.

Appalachian Line

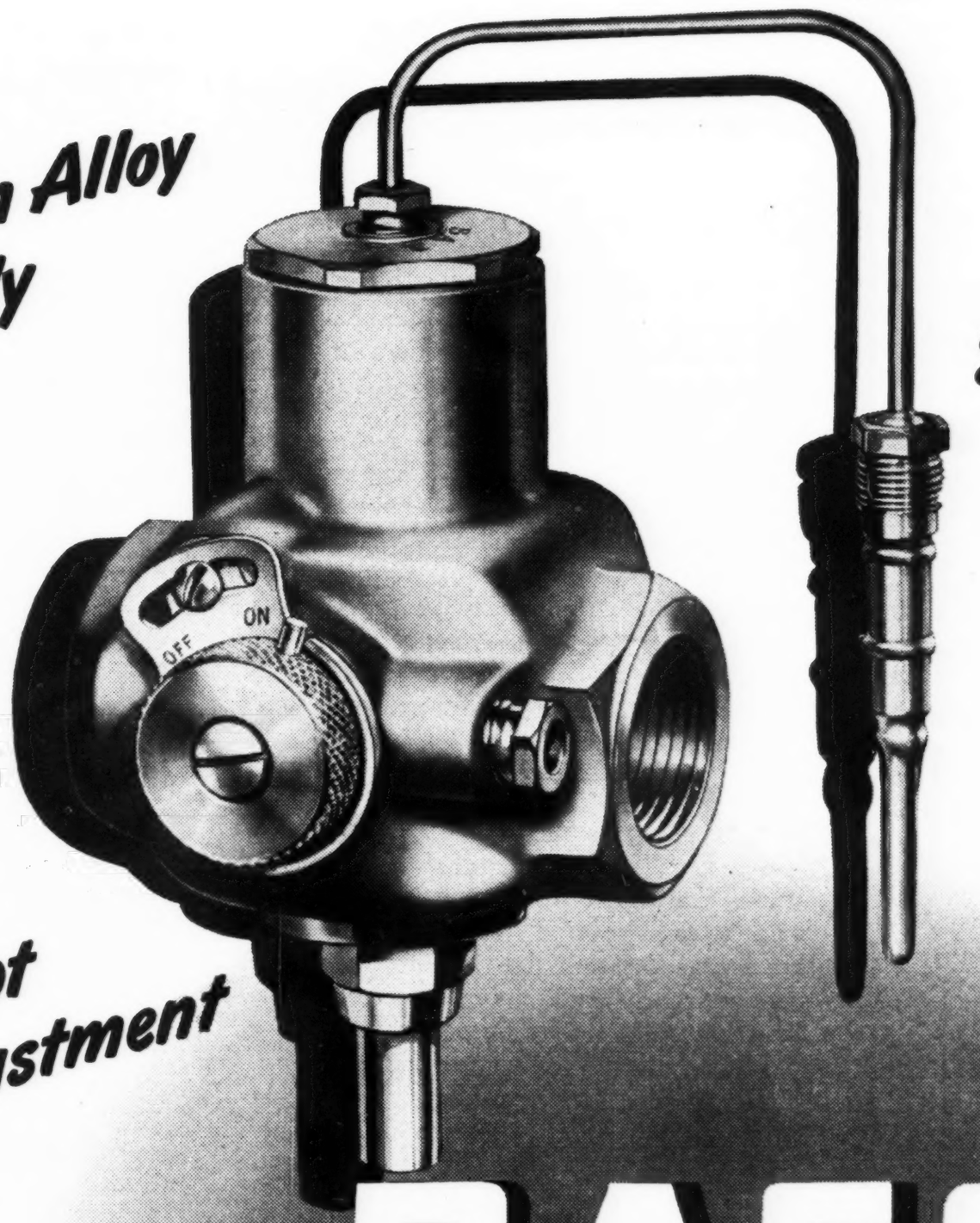
The H. C. Price Co. was awarded a contract last month totaling approximately $8 million, for construction of three sections of 26-in. high pressure natural gas transmission line in the Appalachian mountain area. The contract was awarded the Price company by the Atlantic Seaboard Corp. and Virginia Gas Transmission Corp.

Starting near Cleveland, W. Va., the three sections totaling 200 miles will traverse the Great North, Allegheny and Shenandoah mountains, to the Atlantic Seaboard Corp. property near Rockville, Md. The contract also calls for two major river crossings, consisting of four 16-in. lines across both the Shenandoah and Potomac rivers.

Preliminary work was to begin around April 1 and actual construction the latter part of the month. The line is scheduled to be completed by Dec. 1 of this year. Ex-

Replaceable Reset Assembly

Aluminum Alloy Body



Safe Lighting

Rotor Pilot Valve

Pilot Gas Adjustment

BASO

the Automatic

SAFETY PILOT

gives you **100% SHUT OFF**

- The new A824 Baso Valve, with corrosion resistance of aluminum and stainless steel, easy pilot gas adjustment, rotor pilot valve, and replaceable hood and reset assemblies, enhances the value of . . . Central Heating Appliances . . . Booster Water Heaters . . . Conversion Burners . . . Unit Heaters . . . and other applications up to ¾″ pipe size.

WRITE FOR BULLETIN SC-300-3

MILWAUKEE GAS SPECIALTY CO.
MILWAUKEE 1, WISCONSIN

tremely heavy duty equipment will be required to handle the heavy pipe through the mountainous country. Approximately 1500 men will be engaged in its construction at the height of operations, with the majority being recruited from the construction area.

Pipe required for the project is being fabricated by A. O. Smith Corp.

The three sections awarded H. C. Price Co. are part of a 262-mile pipeline for transporting natural gas for distribution to the area between Clendenin, W. Va., the hook-up point, and Rockville, Md.

M-W Line Asks Facilities

In mid-March FPC hearings began in Washington on the joint applications of Michigan-Wisconsin Pipe Line Co. and Michigan Consolidated Gas Co., both Detroit companies, to construct additional facilities in connection with Michigan-Wisconsin's Texas-to-Michigan pipeline. The pipeline company wants to boost capacity of the line by 28 billion cu ft per year with additional compressor units.

The line was authorized by the FPC in 1946, and called for about 15,000 hp and a capacity of approximately 47 billion cu ft per year. Michigan-Wisconsin wants to add about 32,000 hp to the project. Last December an application was filed for additional facilities, with the Austin Field Pipe Line Co., Detroit, named to share in the construction; an amended application later provided that Michigan Consolidated take over Austin's share of the program.

Michigan-Wisconsin also has proposed rerouting the section of main line to be built between Rulon, Neb., and the "Wisconsin Junction" near Millbrook, Ill., and substitution of 24-in. pipe for the 26-in. pipe authorized to be laid between Hugoton field and the Junction. Michigan-Wisconsin further proposes to furnish Michigan-Consolidated with gas requirements in excess of those supplied under contract by Panhandle Eastern Pipe Line Co. The latter company has been permitted to intervene in the proceedings.

FINANCIAL

Rate Roundup

The rate picture remained fairly stable last month, with some rates being advanced, others decreased, and an argument in Jacksonville, Fla., on the fairness of the local city commission's rate-setting activities:

Jacksonville Gas Corp., Fla., will tussle with the Jacksonville city commission April 12 in front of the Florida Railroad and Public Utilities Commission. Action will be taken by the commission on the company's appeal from consumer rates established by the city. Under a state law passed in 1921 the city commission is authorized to set gas rates, which it did last October.

Iroquois Gas Corp., Buffalo, N. Y., has announced increased rates for consumers who use gas only for cooking, refrigeration, and water heating. Simultaneously, the company said it has lowered rates for space-heating customers on the first 10 Mcf of gas used each month. Both changes were authorized by the public service commission.

Under the new schedule, the domestic (as distinguished from space-heating) rate is 72 cents net per Mcf for all gas used. The old rate was 70 cents. Before the advance there had been a sliding scale of rates which started at 65 cents net. The space-heating rate will be 72 cents for the first block (10 Mcf). Since December 17, the rate for this first 10 Mcf has been 75 cents. Up to that time it was 65 cents.

The changes, the company said, were for the purpose of leveling out the rates at 72 cents. Customers were objecting to the 75-cent charge applying during the summer, when their gas was used only for cooking and water heating.

Washington (D.C.) Gas Light Co. thinks that it must raise its rates soon. "Unless higher costs can be absorbed in a still greater volume of business, it is inevitable that gas rates for some types of services must be raised," Marcy L. Sperry, president, said recently.

The firm is the only Washington utility which hasn't increased rates since war's end.

Now in its 100th year of service, Washington Gas Light last year sold more than 150 million therms, an increase of 18 million therms over 1947, and put a net income figure of $1,476,000 on its 1948 balance sheet. Customer meters in service Dec. 31 totaled 252,052, a gain of almost 10,000 for the year.

RG&E Wins N.Y. Case

The New York Court of Appeals, the state's highest court, in late February ordered the state public service commission to grant Rochester Gas & Electric Corp. permission to issue unconditionally nearly $24 million in new securities. The verdict affirmed an appellate court decision made in early January.

Sustainment of the decision "would strip the commission of virtually all of its supervisory functions in connection with security issues," PSC representatives stated during sessions.

Action grew out of Rochester Gas' petitioning the PSC a year ago February for authority to issue and sell certain stocks and bonds. The commission ruled that before it could okay the issue the utility must establish reserve funds which would "take care of tentative impairments." Rochester Gas went to court about it.

Liquidation Okay Asked

United Light & Railways Co. and its subsidiary, The Continental Gas & Electric Co., holding companies for several Midwest utilities, are preparing to liquidate, according to William C. Woolfolk, chairman of United. SEC approval is necessary.

Major operating units of the system are Kansas City Power & Light Co., the Iowa Power & Light Co., the Iowa-Illinois Gas & Electric Co., and the St. Joseph Light & Power Co.

'Natural Prices Too Low'

The price of natural gas is too low, according to Ernest O. Thompson, a member of the Texas railroad commission. Speaking at a New York meeting of the Associated General Contractors of America, Thompson said that the price of natural averages about 5 cents per Mcf; he indicated that it should be closer to the price of crude oil, possibly about 44 cents per Mcf.

Thompson based his estimate on the Btu

BROWN & ROOT INC., engineers and contractors, and their affiliated companies have moved into new quarters on a 30-acre site at 3600 Clinton Dr., Houston. The new office building is of asbestos siding and is air conditioned throughout. Asphalt tile flooring and acoustical ceilings are other features of the building's modern construction.

content of both fuels. He said that 6 Mcf of gas has the same heat content as a barrel of crude, and that crude now sells for $2.65 a barrel. Breaking down that figure gave him the 44-cent price tag.

He estimated gas production in Texas last year at 2.7 trillion cu ft and stated that much of it was wasted because of lack of markets. Thompson added that new markets developed by pipeline construction to consumer areas will take care of this aspect of gas production.

January Gas Sales High

Therm sales keep rising. January sales by utilities to ultimate consumers were nearly 3½ billion therms, an increase of 8.9% over January of last year, according to the AGA.

The 12-month period ending Jan. 31 showed a larger boost, 11.6%, with the year's total a neat 33,166,185,000 therms. On the last day of January the AGA's index of gas sales stood at 244.5% of the 1935 1939 average.

Natural gas sales made the higher totals, as manufactured and mixed gas sales showed a decline. Natural sales for January were 3,119,786,000 therms, a 12.6% gain, while manufactured gas sales dropped 10.5% and mixed gas 21.8% in the first month of 1949.

For the 12-month period ending Jan. 31 natural gained 14.4%, manufactured dropped .5% and mixed slumped 17.5%.

Equitable on Market

Equitable Gas Co. of Pittsburgh, a subsidiary of The Philadelphia Co. (a subsidiary of Standard Gas & Electric Co.), may be purchased by Consolidated Natural Gas Co. or Columbia Gas System, both of whom own subsidiary companies in competition with Equitable in Pittsburgh. The SEC has directed Philadelphia Co. to dispose of all its natural gas properties, and while the ruling has been appealed, Equitable's top management has approached the possible buyers in the event that the ruling is confirmed. Neither Consolidated nor Columbia has made an offer, according to executives.

REGULATION

Field Prices Fixed

In an order issued Feb. 18, the Kansas Corporation Commission fixed a temporary minimum price of 8 cents per Mcf of natural gas in the Hugoton field to be effective March 1. The commission has denied an application for rehearing. Appeal for relief to the Kansas supreme court is expected. This marks the first time the Kansas commission has entered into natural gas price-fixing.

The Hugoton field in Kansas contains approximately 1355 gas wells, with reserves totaling 12-14 trillion cu ft. The commission's decision raises the value of these reserves more than $350 million.

The decision, based on hearings conducted intermittently since last July, determined that the commission has the power to set gas

wellhead prices through 1935 Kansas legislation. The order stated that the prices would continue in effect until a final decision is rendered.

The average weighted price of gas throughout the field is 5.35 cents, although some contracts specify as low as 3½ and 4 cents.

Jeff Robertson, chairman, Kansas Corporation Commission, stated that the 8-cent figure will be in effect until the commission makes a more complete investigation.

Previous hearings before the commission were on an application by the Southwest Kansas Royalty Owners Assn., together with a number of producing companies. Opposing the application were a number of pipeline companies, including Panhandle Eastern, Northern Natural, Kansas Power & Light, and Cities Service Co. On the eve of the order's becoming effective a motion for rehearing was denied by the commission.

In issuing the price-fixing order, the view was adopted that the commission can assume jurisdiction by implication as the legislature has delegated authority by statutes to the commission. The commission has not adopted the view that jurisdiction cannot be assumed unless it has been specifically granted by the statute.

The entire natural gas industry is interested in the future status of the order. A somewhat similar situation is in Oklahoma where the Oklahoma supreme court is considering the application of a price-fixing order of 7 cents minimum established by the Oklahoma Corporation Commission for the Oklahoma portion of the Hugoton field.

At the close of several months of hearings during 1946 on an application by Peerless Oil & Gas Co., and gas royalty owners, the Oklahoma Corporation Commission fixed a minimum wellhead price of 7 cents per Mcf. The decision was appealed to the Oklahoma state supreme court by Cities Service Gas Co. and others; they secured a suspending order holding the commission rate in abeyance pending final determination of the appeal.

Fearing that the case would be appealed to the United States Supreme Court, whatever the decision, proponents of minimum price fixing backed a bill in the Oklahoma legislature which would specifically authorize the corporation commission to fix minimum gas wellhead rates under certain conditions.

The bill authorizes the corporation commission to fix the minimum price of natural gas beyond the limits of the "utility rule of reasonable return and investment" and to take into consideration "any and all factors which in the discretion of the commission, shall be conducive to the attainment of the purposes of this act." These purposes are declared to include authority to the commission to make such rules and regulations as will prevent discrimination in the marketing, selling, and purchasing of natural gas in excess of market demand, prevent its waste, and promote its ratable and equitable taking. The proposed legislation declares that low wellhead prices, coupled with limited and inequitable taking, result in wasteful disposition and utilization of this great resource.

Floyd Green, general counsel, Oklahoma Corporation Commission, told the legislators at a hearing on the bill that the commission is taking no stand on the measure at this time. He added that the commission believed it had authority to make the 7-cent minimum price under general powers conferred upon it by the gas conservation act of 1913.

Supporters of the bill at the hearing contended that the legislature possesses this price fixing authority or can confer it on the corporation commission.

Royalty owners told the committee that wellhead prices of natural gas at the well in the Hugoton field had averaged only 4 cents per Mcf for the past 10 years and had not gone up because they were not subjected to the law of competition.

Opponents of wellhead price fixing contend (1) The principle of conferring power on any state or federal department or board to fix non-utility rates or prices on any natural resource or product is contrary to the economy of free American enterprise. (2) Gas companies, especially transmission line concerns, find that long term contracts are necessary to insure just returns on investment. (3) Economic reasons often make it impractical to have a hookup where well owners ask it. (4) With federal agencies fixing market prices and state commissions fixing rates, the pipelines would be caught in the middle, if the state or federal commissions were to fix wellhead prices. (5) Wellhead price increases would be reflected in consumer price, causing financial difficulties for gas transmission and distributing companies, resulting either in loss to these companies or higher rates to consumers.

Waynesboro Hearing

The complicated proceedings concerning the Waynesboro (Pa.) Gas Co.'s request to be hooked up with the Manufacturers Light & Heat Co. of Pittsburgh are to be reopened the 6th of this month. Waynesboro wants gas from Manufacturers in amounts

July Safety Issue

Orders for the special July Safety Issue of *GAS* are pouring in. Typical of comments from the industry on the big issue —which will contain more than 200 pages covering operations in every phase of the gas utility and appliance industries—is a letter from G. W. Holbrook, vice president of the Empire Gas & Fuel Co., Ltd., Wellsville, N. Y.:

"We enclose herewith our order for 50 copies of the special issue of *GAS*, which is going to cover the hazards and safe methods of handling gas. We want these to use for those of our employees who are in direct contact with the public, with employees of our appliance company, and for distribution to a few other appliance dealers in our territory."

Price of the Safety Issue will be $2 unless ordered in advance of publication —in which case the special price of $1 will be made. Write Jenkins Publications Inc., 198 S. Alvarado, Los Angeles 4, Calif.

necessary to supply its estimated peak day requirements of 166 Mcf this year, 183 Mcf in 1950, 210 Mcf in 1951, and 253 Mcf in 1952.

Original application was filed last Aug. 27. An oral stipulation made by Waynesboro last December, whereby the company withdrew its application, was permitted to be withdrawn with this new order. Counsel for Manufacturers stated at the December hearing that the Columbia Gas System (of which Manufacturers is a member) would file an application to supply gas to Waynesboro before it took on any new markets. Waynesboro stated in January that Columbia Gas had refused to be bound by counsel for Manufacturers, requested the withdrawal of the oral stipulation, and asked for proceedings to be reopened.

Arkansas Bill Signed

Act 71 of the Arkansas legislature's 1949 session, which authorizes municipalities to issue revenue bonds to build and operate natural gas systems, has been signed by Gov. Sidney S. McMath. The bill, introduced by Sen. Winfred Lake of DeQueen, first included artificial gas systems in its provisions, but these were excluded by amendment before its passage. The bill as enacted into law also excludes cities or towns which already have operating gas systems under private ownership.

Those taking advantage of the act will adopt ordinances stating estimated cost, total bond issue, interest rate, time and place of payment and other details. The bonds will be a mortgage lien on property to be constructed and will be payable solely from revenue from gas property. Bonds may not be sold at less than 90 cents on the dollar and must be negotiable and sufficient to pay all costs plus interest for six months subsequent to estimated completion of construction. The maximum interest rate allowable is 5% and maximum principal maturity 35 years. The lien on the gas system will remain effective until fully paid.

Rate Hearing Postponed

The FPC hearing on Texas Eastern's proposed supplemental rate schedule revisions, set for mid-March has been indefinitely postponed. Texas Eastern had applied to increase rates and charges by application of tax adjustment clauses reflecting the new Louisiana tax upon gas produced in that state.

The company agreed that if this new postponement (the third on this application) was granted it wouldn't move to put the schedules into effect before final determination in the proceeding by the FPC.

Inspection Law Passed

The City of Memphis' new gas inspection law, which calls for city approval of new gas appliance and heating installations, went into effect early last month. Anyone installing a new gas appliance must obtain a permit from the city's gas inspection bureau (part of the department of public service) and

have the installation checked by a gas inspector before it is lighted.

Permit costs range from $1 up, depending on the value of the installation. Exempt are replacements of gas cooking ranges and small heaters.

SEC Eyes Stock Relations

Stock relations between Cities Service Co. and its subsidiary, Arkansas Natural Gas Corp., are undergoing scrutiny by the Securities and Exchange Commission. The commission believes it possible that the corporate structure of the Arkansas system is "unnecessarily complex."

It also expressed doubts as to the fairness of distribution of voting power among security holders of the corporation.

MISCELLANY

ConEd, Unions Agree

The joint council and local unions of the Utility Workers' Union of America (CIO) and officials of the Consolidated Edison System companies, N. Y., in March signed a two-year contract with clauses guaranteeing no strikes and no lockouts, a union shop provision, and a provision requiring disclosure of any employee of membership in any subversive organization. The latter is believed to be the first of its type in any major utility contract. It will require each applicant and job holder to notify the company and the union if he was or is a member of any subversive organization.

The disclosure was stated to be for informational purposes only, without any penalty provisions, but as a safeguard in case of national emergency.

The entire contract carried out the settlements reached late in February, when the union cancelled a strike notice which had threatened to affect gas service in Manhattan, the Bronx, portions of Queens and Westchester, and electric service in most of New York City and Westchester.

A joint release by company and union stated that the new contract provides for a 7 cents an hour across-the-board increase, and additional increases of 2½ cents Jan. 2 and 2½ cents July 3 for employees below the maximum rates of their job titles and two increases of 2½ cents on those dates for those at the maximums who must work on Sunday. Total wage increases have been estimated at an average of 11 cents an hour, with the bill for the year approximately $6½ million.

Oklahoma Modernizes

In early March the Oklahoma Natural Gas Co., Tulsa, formally opened its new main floor business office and display lobby and its second floor "Culina Room," operated by the company's service department. The Culina (Latin for "kitchen") Room is a gas air conditioned meeting room for clubs, social gatherings, and parties. It may be reserved for large gatherings of all kinds, and is outfitted with chairs, bridge tables, china, silver, etc.

It has a New Freedom Gas Kitchen and an adjoining model laundry with an automatic water heater, laundry, and gas clothes dryer . . . all the necessities of the modern home. Special demonstrations and lectures about food preparation, kitchen planning, and laundering methods may be arranged for club or church programs.

New Hospital Plan Set

A new hospital and surgical benefit plan, designed to provide employees and their dependents with broad and liberal benefits, has been announced by the Pittsburgh Group companies of The Columbia Gas System Inc. The plan includes group hospitalization benefits up to $7 a day and group surgical benefits ranging from $5 to $200. Provisions are made for the payment of doctor's calls for patients who are hospitalized and maternity benefits are available for dependents.

This new plan was to have become effective on April 1, assuming that at least 75% of the eligible gas employees of the gas companies made application for its provisions. The cost of the plan will be borne jointly by the employees and the gas companies.

This new hospital and surgical insurance program is in addition to the group life insurance plan and retirement program which are now available to Pittsburgh Group men and women.

Gas Plant May Go

The coal gas plant which has been supplying manufactured gas to the citizens of Brandon, Manitoba, first as a private company, and more latterly taken over by the Manitoba Power Commission, will close down next June 1 if nothing to bring about its continuance happens before then.

Most of the present consumers will not be in a position to take on major electric cooking services, and some will not get the power required to operate such equipment, judging by the ever growing shortages of electrical energy in many Canadian provinces.

100th Anniversary Feted

The Lawrence (Mass.) Gas & Electric Co., part of the New England Electric system, celebrated its 100th anniversary Feb. 14. In a full page ad in the *Lawrence Evening Tribune,* the company recalled its history, displayed pictures of buildings from which it has operated through the years, and called attention to the role the company has played during Lawrence's development.

Since its beginning, the company's capital stock has grown from $55,000 to $4,700,000. Its president today, Fred Sargent, began with the company as a timekeeper and record clerk Nov. 26, 1889.

Type 26AO1

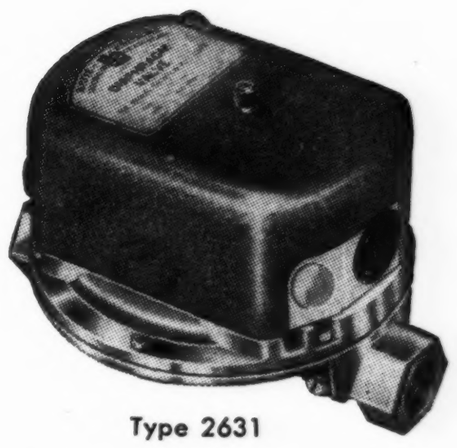
NEW

Compact, Quiet, Interchangeable with Solenoid Valves,

this *NEW* Small WHITE-RODGERS Diaphragm Gas Valve now brings you

TOP QUALITY PERFORMANCE

- Ideal for replacement
- Fits regional requirements
- Better for unit heaters
- Quieter for floor furnaces
- Manual reset optional
- For any kind of gas
- ½" and ¾" pipe sizes
- A.G.A. listed



Type 2631

White-Rodgers standard size diaphragm valve

Write for complete catalog of gas valves and safety pilots.

WR

ELECTRIC CO. ST. LOUIS 6, MO.

FOR REFRIGERATION · HEATING AND AIR CONDITIONING

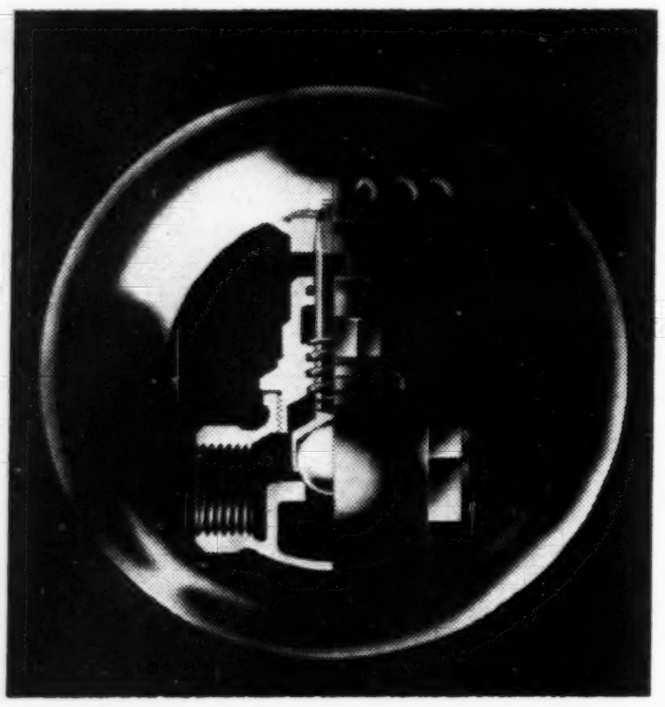
NEW PRODUCTS

Ball Valve

THE CARPENTER MANUFACTURING CORP., 9523 Detroit Ave., Cleveland 2, Ohio.

MODEL: Bull-Dog ball valve.

DESCRIPTION: A precision ground stainless steel ball is used instead of discs, pop-



pets, etc., effecting a lifetime seating member with harmless effect upon the seat. The ball is spun into its retainer allowing a slight clearance, which permits the ball to spin when the valve is opened or closed, thus permitting it to find a new seat each time. Care is exercised to hold the ball clearance accurately, thus preventing chatter when opening, closing, or throttling.

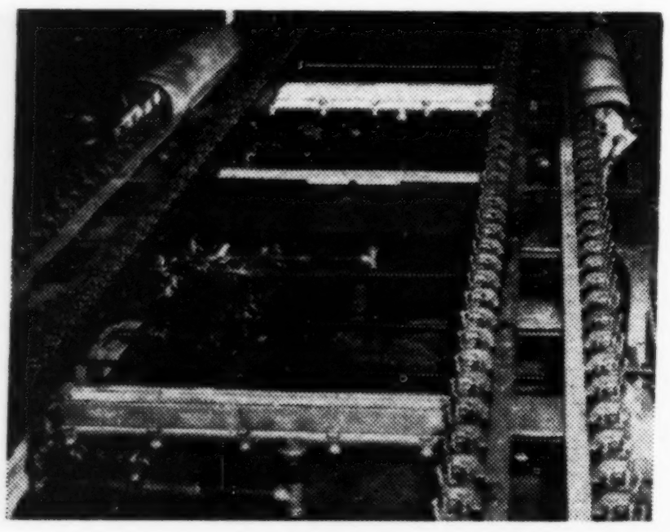
The valve is supplied with "O" ring seals for normal service where high temperature is not involved. Conventional steam packing is used in valves installed in steam or other high temperature service. Improved flow characteristics are said to be a natural result of the ball shape. The valves are available in ½ in. and ¾ in. pipe sizes.

The manufacturer states that several years of field tests have resulted in highly satisfactory reports.

Infrared Generator

PROCESS HEATING INC., 346 Warren St., Brooklyn 2, N. Y.

MODEL: Gas infrared generator.



APPLICATION: According to the manufacturer, this product has stepped up production in the textile field from 100% to 200% under tenter frames (see illustration which shows tenter frame equipped with gas-burning infrared generators), 100% on slashes, 100% or more when used as booster on steam cans, and about 250% on singers. It will cure material at a speed of 60 yd per minute on four-color roller printing.

DESCRIPTION: The generator burns with flameless, practically 100% combustion. Burner is made up of special cast iron segments, up to 12 ft in length in inch increments. A scientifically designed port permits the burning of natural, manufactured, propane, butane, mixed, or vaporized gas against a ceramic which becomes incandescent, generating infrared rays and convected heat or hot air.

Diaphragm Gas Valve

WHITE-RODGERS ELECTRIC CO., 1209 Cass Ave., St. Louis, Mo.

APPLICATION: Their quiet operation and relatively high gas capacity suit these valves for unit heaters, gas-fired circulators, compact type boilers and furnaces, and floor furnaces.

DESCRIPTION: The length dimensions of these valves are identical with solenoid valves of the same pipe size, making them ideal for replacement where users prefer the more quiet

operation of the diaphragm type valve. Equipment manufacturers can change over in production without delay or changing assembly parts. Because of their compact size, the valves can be used on a variety of gas-fired applications where previously the standard size diaphragm valve could not be used.

The valves may be easily dismantled for cleaning or replacement of parts in the field. A manual operation feature is optional. It permits opening the valve manually in the event of power failure, and the valve will return to automatic operation upon return of electric service.

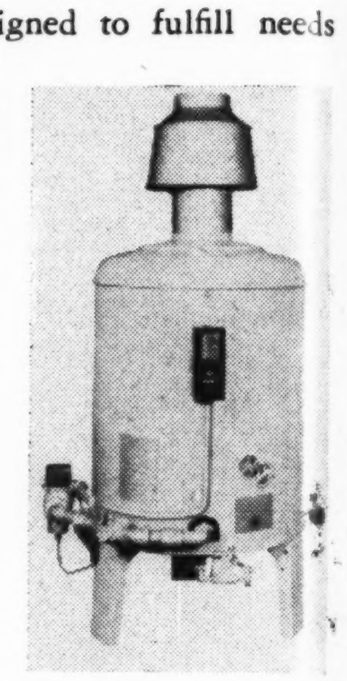
Furnished in ½ and ¾ in. pipe sizes, the valves may be used with natural, manufactured, or mixed gas and are also available for LP-Gas on special order. They operate on 24 volts; other voltages are available. AGA listed.

Water Heater

A. O. SMITH CORP., Kankakee, Ill.

MODEL: Smithway-Burkay 417.

APPLICATION: Designed to fulfill needs too small to be met economically by large commercial water heating units — small restaurants, small apartment buildings, large homes.



DESCRIPTION: The heater is similar in appearance and construction to the company's model 617, although it is smaller in dimensions and has a lower Btu input. Overall height is 4 ft and diameter is 18 in. Its Btu input is 110,000/hr and it can recover up to 176 gal/hr.

Safety equipment includes high limit control, a finned heat exchanger that assures instant response to hot water demands, a burner employing two stages of primary air injection and a secondary air supply, and an efficient "water-wall" combustion chamber of tightly wound copper coils. This AGA-approved model, because of straight on-off operation, is a tank heater and cannot be used for instantaneous, booster or booster recovery installations. Its forced flow recovery circulation provides more even tank temperature and makes it possible to install heater and tank in separate locations or on different levels.

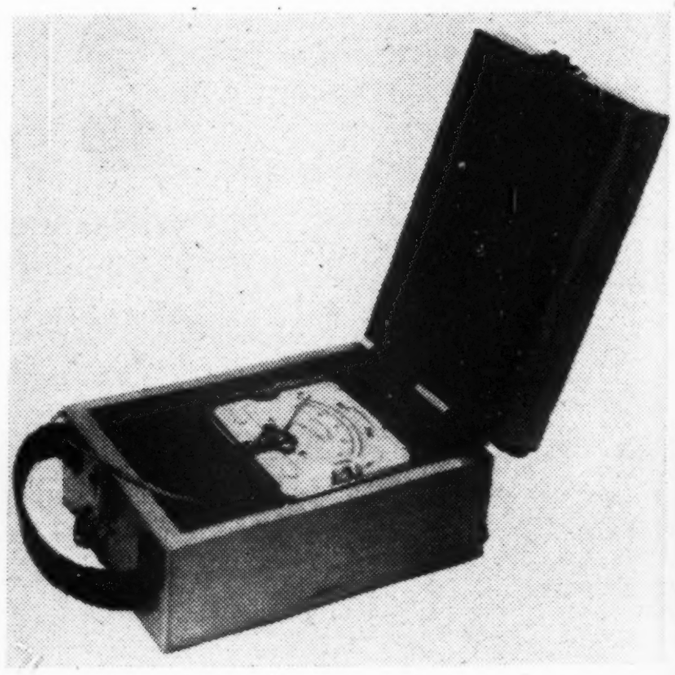
Oven Pyrometer

ASSEMBLY PRODUCTS INC., Chagrin Falls, Ohio.

MODEL: Simplytrol 1654-B.

APPLICATION: For measuring temperature inside the oven without opening the oven door.

DESCRIPTION: Electrically, the instrument is the same as Model 1654-A. It is supplied with a thermocouple wire 5 ft long. Much



time is said to be saved in setting oven controls. Temperature range is 0.750°F or 0-400°C.

The Simplytrol is now available in a hand rubbed, maple carrying case. The case has a hinged cover with lock and leather strap handle.

PEOPLE

T. O. LAWLER has been named a regional manager for the Timken Silent Automatic Division, Jackson, Mich. His territory includes Ohio, West Virginia, Indiana, Kentucky, and Tennessee. Seven new district sales managers also have been appointed: JOHN A. PRATT, Maine; JOHN J. MORRO, western Connecticut and western Massachusetts; HANFORD GRUHER, New Jersey; E. M. CAHILL, Illinois; F. H. HUBER, Iowa, Missouri and Nebraska; WILBUR W. GREGG, Michigan; ROBERT S. DANIELS, Kentucky, Ohio and West Virginia.

ROBERT E. SCHILL of Brooklyn Union's economic research department has been elected by the board of directors to fill the post of assistant secretary left vacant by the resignation of Leonard F. Genz. Mr. Schill was employed in the new business and rate departments before the war and returned to the company in 1946 after four years in the Navy.

FRANK F. GLENNEY and J. G. LANE have been appointed to new sales positions with Houston Natural Gas System. Mr. Glenney is manager of residential and commercial sales, Houston division. This position was vacated by the resignation of EDWARD N. HEARD, whose health compelled him to leave the company after 20 years of service. Mr. Lane, new business representative, succeeds Mr. Glenney as dealer coordinator.

FLOYD S. PARMENTER recently was appointed to the newly created position of manager of sales, Southern Counties Gas Co., Los Angeles, it was announced by Vice President Norman R. McKee. Mr. Parmenter will take over the management of all appliance sales and collateral activities in the sales department. CLYDE H. POTTER, former appliance sales manager, has been assigned to public relations work under Mr. McKee, and has the title of special assistant.

R. F. OGBORN, former assistant Los Angeles district manager, has been appointed manager of the customers department of Southern California Gas Co., replacing the late H. E. Davidson. Mr. Ogborn joined the company in 1926 at the Burbank, Calif., office. Later that year he was transferred to Glendale, and then served successively in Los Angeles, Bakersfield, Pasadena, and finally in the customers department in the home office.

M. J. STEVENS, well known in the gas appliance industry, recently purchased Republic Heater Corp., Huntington Park, Calif. Mr. Stevens was former owner of Vermont Tool & Supply Co. and the Golden State Glass Co., both of Los Angeles. He was connected with the Peoples Gas Light & Coke Co., Chicago, for several years before moving to California. MISS OPAL MITCHELL, formerly with Rheem Manufacturing Co. and Pioneer Manufacturing Co., has been appointed vice president in charge of national sales. MRS. L. REED, former owner, will assist in an advisory capacity. WHITNEY REED, son of Republic's founder, will remain in charge of local sales.

M. J. Stevens

H. EMERSON THOMAS has announced that his firm of LP-Gas engineers, contractors and consultants, has been incorporated because of recent expansion. The company, which is located at Westfield, N. J., is now known as H. Emerson Thomas & Associates Inc.

DAVID S. REYNOLDS has recently been appointed New England representative for The Gas Machinery Co., Cleveland, Ohio. According to President K. W. Stookey, Mr. Reynolds' services will be made available to gas plant operators throughout New England and as far south as New York City. He is qualified to furnish consulting service or equipment information. In 1947 Mr. Reynolds retired from his position as vice president and chief engineer of the Boston Consolidated Gas Co. Since retirement, he has acted as consultant to several gas companies in New England.

C. S. WORLEY, chief engineer and purchasing agent, Consolidated Gas Utilities Corp., Oklahoma City, retired on March 1. Mr. Worley is opening an office in Oklahoma City where he will serve as a consultant on design of natural gasoline plants and booster stations. He will also establish a general appraisal practice. Mr. Worley has been associated with Consolidated Gas for 20 years.

FOSTER DEE SNELL, president of Foster D. Snell Inc., New York firm of consulting chemists and engineers, has been named by the Society of Chemical Industry, London, to receive the society's Gold Medal for 1949. The award is made bi-annually to a person "who has attained eminence in applied chemistry." Since the award was established in 1896, only one American—Prof. Ira Remsen of Johns Hopkins University—has been so honored.

DAVID A. LEWIS has been appointed general operating superintendent of the New York State Electric & Gas Corp., Ithaca. From his Binghamton headquarters, Mr. Lewis will supervise technical operations of the company throughout the state.

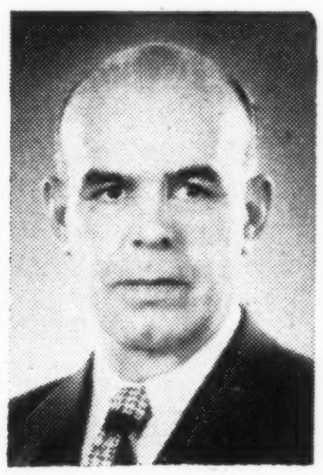
DANIEL U. PINDER has been appointed to the staff of business consultants of Ebasco Services Inc. New York. Mr. Pinder previously was engaged in research and analytical work.

A. W. WALLACE and R. M. GARRETT have taken over West Coast sales territories for Taylor Instrument Co.'s, Rochester, N. Y. During recent months, the broad academic background of these men has been augmented by training and experience in process control instrumentation at the company's home office. Mr. Wallace is located in Portland and Mr. Garrett in Los Angeles.

W. H. BARNES has joined Clark Bros. Co. Inc., of Olean, N. Y., as a member of the technical service staff in the Tulsa, Okla., office. Mr. Barnes worked for the Bureau of Mines in Bartlesville after graduating from the University of Oklahoma. Then he went to MIT and received an MS in chemical engineering in 1938. He was on the technical staff of the Standard Oil Co. of Indiana for three years and spent a year with Stanolind Oil & Gas Co. of Tulsa, specializing in designing and test work on natural gasoline and recycling plants.

NEWELL E. LOOMIS has been elected vice president-sales manager of Michigan Consolidated Gas Co., Detroit. He has been sales and advertising manager for the Detroit district since 1932 and will now be in charge of sales and advertising for all districts of the company. Mr. Loomis started as a stenographer in Michigan Consolidated's new business department 40 years ago. He is a former president of the Michigan Gas Assn. and an active member of the AGA.

F. S. Parmenter
. . . SoCounties

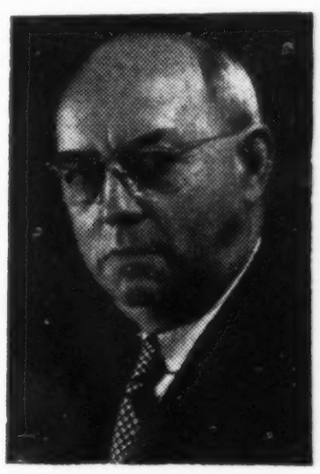


R. F. Ogborn
. . . SoCal

D. S. Reynolds
. . . Gas Mach.

C. S. Worley
. . . Cons. Gas

W. H. Barnes
. . . Clark Bros.



N. E. Loomis
. . . Mich. Cons.

J. H. LEWIS has retired from his position as assistant sales manager of Grayson Controls Division, Robertshaw-Fulton Controls Co., Lynwood, Calif., after 17 years of association with the gas industry. L. A. SIDWELL, who has served as assistant production manager of the Grayson Division for the past two years, has been added to the company's sales department.

MARY M. MARTZ has been made home service director of The Manufacturers Light & Heat Co., Pittsburgh. Working under the general supervision of Ray A. Newbold, district manager, Miss Martz will headquarter in Uniontown. She and Miss Regina Jernstrom will work together on the expansion of home service activities in the company's distribution district No. 6.

JAMES F. DORAN, widely known in the public utility field, has been chosen to represent Caloric Stove Corp. in the metropolitan New York area. He will handle special assignments on the Caloric line of gas ranges and will cover the utilities in the area.

EARL CLIFTON has been appointed manager of the Camden district, Arkansas-Louisiana Gas Co., as successor to the late A. C. BIBENS. Mr. Clifton joined the company in 1926 and has served as manager of the Hope, Ark., district since 1944. New manager at Hope is J. FRED GRESHAM, formerly in charge of the company's Morrilton, Ark., properties.

FRANK H. TREMBLY JR. has been appointed sales manager of The Philadelphia Gas Works Co., succeeding H. S. Christman, who died recently. Mr. Trembly has served as the company's assistant sales manager for the last 15 years and has been very active in the AGA and the Pennsylvania Gas Assn. From 1924 to 1931 he was employed by Surface Combustion Corp. in engineering and sales work.

EARL M. CONVERSE was appointed senior vice president and Eugene P. Fager was elected vice president and industrial department manager of Dearborn Chemical Co., Chicago, at a recent stockholders' meeting. Mr. Converse has been associated with the company for 46 years and has been honored by the American Society of Metals and the American Chemical Society for outstanding service.

HUDSON R. SEARING was elected president of the Consolidated Edison Co. of New York Inc. at a recent meeting of the board of trustees. He succeeds RALPH H. TAPSCOTT, who was elected to the new post of

Hudson Searing

Ralph Tapscott

chairman and who will continue as chief executive officer. HARLAND C. FORBES, a vice president since 1945, was elected executive vice president, the post held by Mr. Searing since 1944.

DR. EMORY N. KEMLER of New York City has succeeded DR. JOHN V. PENNINGTON as associate director of Southwest Research Institute, Houston. Dr. Kemler resigned the post of acting director of research for New York University to administer the institute's program in Houston. Dr. Pennington is on leave of absence to direct the Drilling Research Inc. program begun recently.

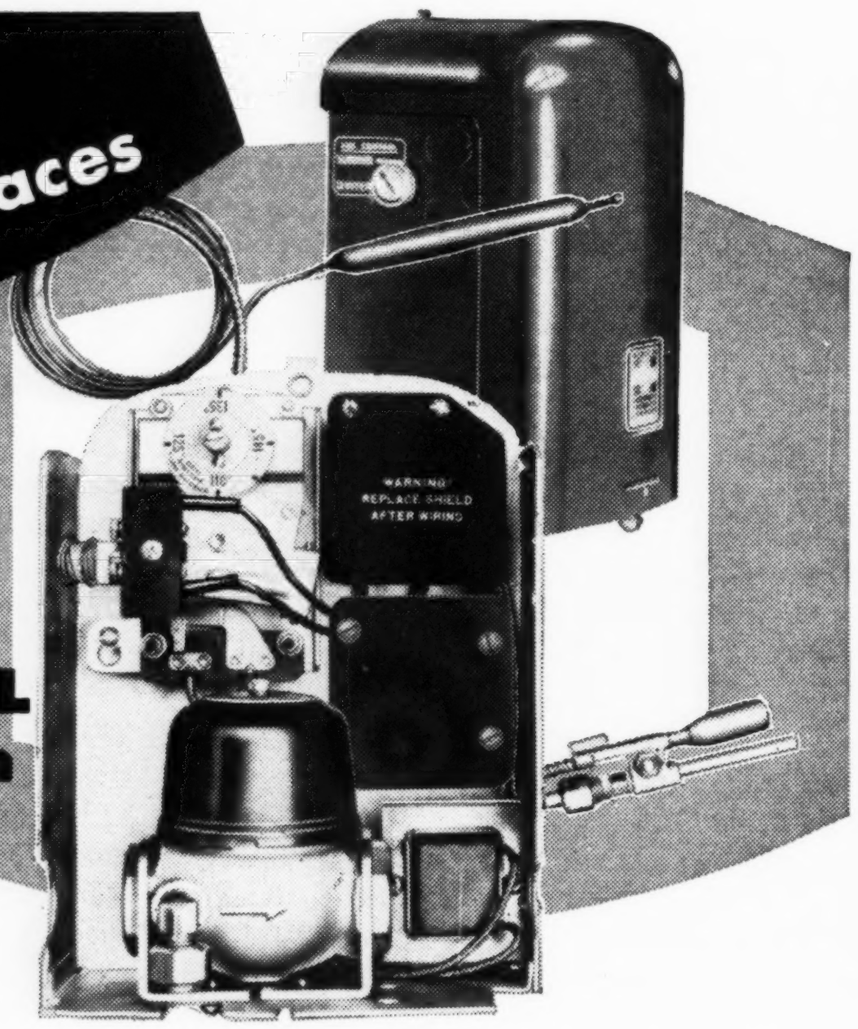
W. O. LAMSON JR. has retired after 50 years of service in the gas and electric industries. Employed by Philadelphia Gas Works in 1899, he worked in UGI-owned gas companies in Omaha, Waterbury, Conn., and Allentown, Pa. Since 1906 he has been manager of the Chester County Gas Co., West Chester, Pa.

WILSON W. WHEELER has been appointed sales manager of Askania Regulator Co., Chicago. Mr. Wheeler entered Askania's sales engineering department in 1941 and became head of it in 1945.

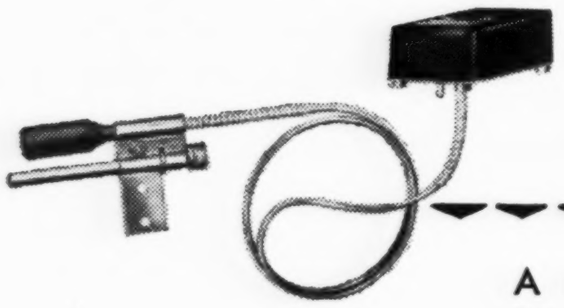
New Production Savings for Gas Furnaces

Gas UNAPAC

Provides for ALL Control needs in ONE COMPACT STREAMLINED UNIT



● This "All-In-One" Gas Furnace Control unit includes: New "Non-Gumming" Model 162 Solenoid, Electric Automatic Pilot, Combination Fan Switch, and Limit Control and Summer-Winter Fan Switch, Built-In Transformer, Thermostat Wiring and Complete Terminal Board. It affords production savings by simplifying assembly and installation — only *one* complete unit to install — no intricate wiring or piping. Costs less than separate controls and materials. Improves furnace efficiency, appearance, and operating satisfaction.



New "Fail-Safe" Electric Automatic Pilot

A new UNAPAC feature that offers positive "Fail-Safe" protection on natural or manufactured gas; shuts off gas if pilot flame goes out; has no moving parts in heated zone; requires no "button-pushing" for relighting.

Add A-P DEPENDABLE Gas Controls to YOUR Appliances. Write for complete A-P Gas Control Catalog.

PROTECTED GAS CONTROLS PERFORMANCE

AUTOMATIC PRODUCTS COMPANY

2526 North Thirty-Second Street • Milwaukee 10, Wisconsin

DEPENDABLE

CONTROLS FOR HEATING . . .
AIR CONDITIONING . . . REFRIGERATION

LYLE C. HARVEY, president of the recently formed Affiliated Gas Equipment Inc., has announced the appointment of W. J. BAILEY JR. as vice president in charge of West Coast operations and general manager of the Payne Furnace Co. division in Beverly Hills, Calif. C. F. CUSHING has been appointed assistant general manager in addition to his present position as director of sales. Mr. Bailey, who has long been general manager of Day & Night Manufacturing Co., Monrovia, Calif., will supervise the operation of both companies, which will retain their independent marketing functions. In replacing E. L. PAYNE, who has left the employ of the company after 34 years of service, Mr. Bailey stated that no immediate changes in personnel or policies are contemplated.

C. FRED LUCAS has been elected vice president in charge of sales for Florence Stove Co., Gardner, Mass. Mr. Lucas was the company's Southern sales division manager and, more recently, general sales manager. FRANK B. JEREMIA has succeeded H. T. Stockholm, resigned, as Midwest division sales manager. His headquarters are in Kankakee, Ill.

GORDON HENTZ has been appointed general sales manager of The Estate Stove Co., Hamilton, Ohio. Mr. Hentz previously was acting as division manager of the New England and New York division.

- OBITUARIES -

ELMER G. DIEFENBACH, 55, executive vice president of the American Securities Corp. of New York City, died Feb. 27. Although he was engaged as a financier, Mr. Diefenbach was prominent as a speaker and writer on natural gas, had been a leader in the construction and financing of the natural gas distribution industry, and aided the development of what have become the country's principal natural gas systems. He was a director of Panhandle Eastern Pipe Line Co.

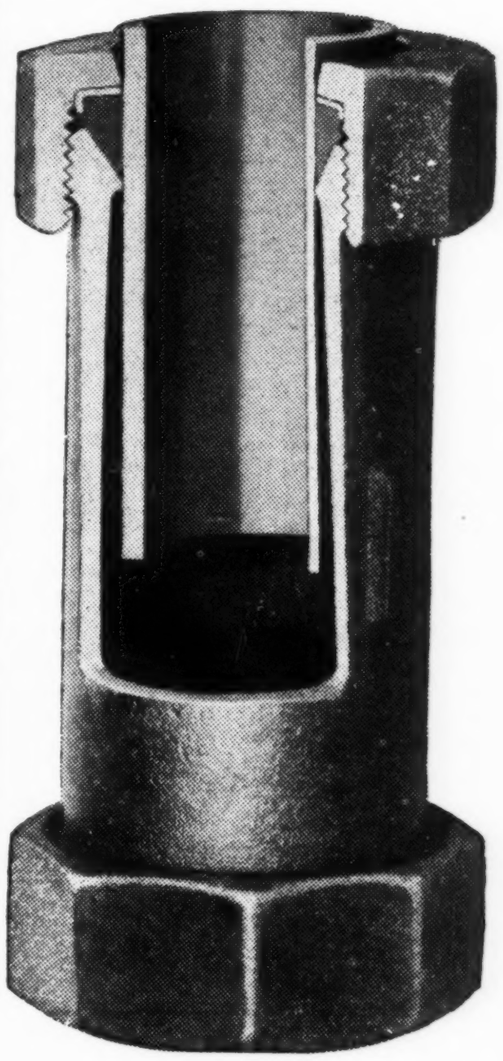
CHARLES E. REINICKER, 63-year-old Philadelphia Chamber of Commerce executive, died on March 2. For 22 years Mr. Reinicker was associated with United Gas Improvement Co., finally as assistant to the executive vice president. In 1941 he joined the War Production Board as deputy director for the Philadelphia region and in 1945 went to the chamber of commerce.

THOMAS E. SAYLOR, 77, retired Washington (D.C.) Gas Light Co. employee, died recently after a six-month illness. Mr. Saylor retired in 1940 after 35 years of service as stationary engineer at the Takoma Park boosting station.

GEORGE H. CURRY, former purchasing agent for Laclede Gas Co., St. Louis, died Feb. 15. Mr. Curry retired on July 1, 1948, because of ill health. He joined the company in 1903 as a member of the stores department.

HOWARD S. CHRISTMAN, sales manager of the Philadelphia Gas Works Co. for the past 16 years, died on Feb. 17. Mr. Christman had been associated with the company for 39 years.

NORMAC
COUPLINGS, SLEEVES and FITTINGS

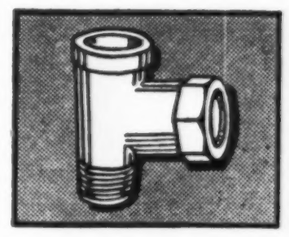


for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

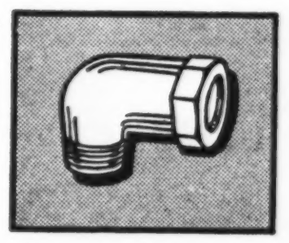
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

COMPRESSION-END SERVICE "TEE"



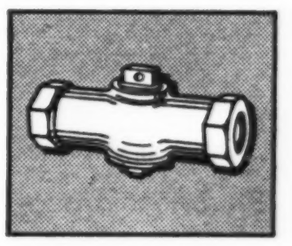
First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

COMPRESSION-END SERVICE "ELL"



Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

COMPRESSION-END IRON BODY BRASS CORE SERVICE STOPCOCKS



End the necessity of threading on the job plus the elimination of the threads themselves — combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

NORMAC BRASS FITTINGS DEVELOPED IN 1939 FOR USE WITH COPPER TUBING

Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

39 SOUTH LA SALLE ST. • CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

"My operating cost was only .0206¢ per foot for cutting 130,487 feet of ditch."

Lee Teutsch, Owner, Ditch Digging Contract Service, says this about the

Longhorn Mobile Ditcher

Purchasing my first Longhorn Ditcher in February 1948, this machine dug 130,487 feet of ditch in the remaining ten months of the year. Varying from 20" to 36" in depth and from 8" to 12" in width the longest part of this work was on ditch 8" wide and 33" deep. A wide range of soils was encountered—hard clays, sticky clays, iron ore rocks, and sand, yet my total operating, repairs, and maintenance cost showed a cost per foot of only .0206¢, exclusive of operators' wages.

LONGHORN MOBILE DITCHER

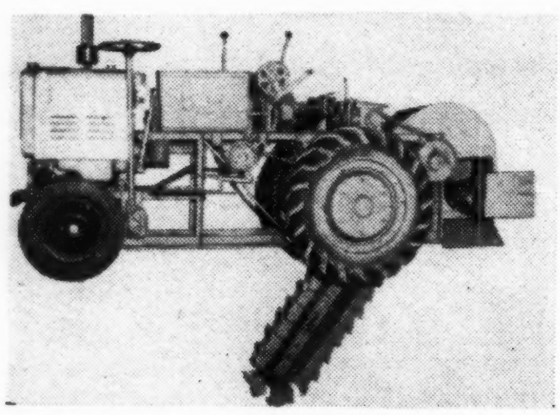
Has 90% of the features that distribution superintendents desire.

1—digs a 6" to 12" trench up to 42" deep, at a rate of 4 to 8 feet per minute; rated speed 1 to 25 feet per minute.

2—one-man operation.

3—travels on highways under its own power at 15 m.p.h.

4—43" tread squeezes into narrow places: can be spread to 63".



5—"hip" action allows operation of 30% lateral slope without undercutting.

6—weighs 5,000 lbs.

7—turning radius 12 feet.

WE WELCOME INQUIRIES . . *It will be a pleasure to send you complete information about the Longhorn Mobile Ditcher . . to answer your special questions. Let us hear from you.*

Longhorn Industries, Inc.

Henderson, Texas **Phone 1035**

HOME SERVICE

Last month GAS presented in this department excerpts from some of the papers presented at the AGA Home Service Workshop held in Cleveland, Ohio, Jan. 24-27. The following abstracts are from other noteworthy papers presented at the workshop.

Neighborhood Cooking Schools—Florence J. Neely, Consolidated Gas Electric Light & Power Co., Baltimore, Md.

Neighborhood cooking schools have proved to be a very successful venture for the Consolidated Gas Electric Light & Power Co. ever since their inception in 1930. . . Each school runs two weeks. There is one night classs for those who cannot come during the day. . . The demonstrators rotate among the schools, each one handling an entire two-week period. Programs are planned ahead and multilithed so that each person has a copy of the recipes used daily, and at the end of the school she is sent a complete set of our recipe booklets.

There is a contact man for the school who works with potential sponsors. Women's church organizations and community associations are the two most common. We pay such organizations $25 for the use of the room and . . . reimburse them for . . . gas and electricity used during the period.

The physical unit is a 12 x 15 ft platform with a back wall. Furnishings include two gas ranges, one deluxe and one apartment size, a gas refrigerator, and a number of cabinets. The demonstration table in the center of the platform is topped by a large reflecting mirror. Equipment is held to a minimum for efficiency. The programs are fairly standard in pattern so that all equipment is used during each school. Should a demonstrator venture far outside this basic pattern, additional pieces can be taken from our main kitchens.

Last year we held 25 gas schools with a total attendance of 15,551 or an average of 622 per school. Daily attendances range from 45 to 140. A high percentage of the audience attends at least five sessions and may attend all. We have no tangible way of determining the load added to the lines, but the records indicate that the load in the territory of the cooking school increases after each school.

* * *

Scholarships—Jane M. Schroeder, Minneapolis Gas Co., Minneapolis, Minn.

The idea for our home service scholarship originated with Harry K. Wrench, president of Minneapolis Gas Co. The value and contribution of a home service department to a successful overall operation is well known in the gas industry. In fact, the recognized importance of a well staffed home service department has created a tremendous demand for college-trained home economists for this work. . .

The matter was approached from the viewpoint that Mr. Wrench was interested in giving two scholarships a year to home economics students because these graduates had proved themselves capable of making material contributions to our organization. Not only was the purpose to help girls financially but also to familiarize more girls with the

opportunities in home service. The faculty members present were informed that we did not know how these details could be arranged but we wanted to learn. Ideally, the company would like to give two girls $500 scholarships and part time work and the accompanying pay for one year. . .

These are the essential points contained in the scholarship which has been approved by the board of regents, University of Minnesota:

1. Applicant must be a junior or a third quarter sophomore in the college of home economics.
2. She must be a major in foods in business.
3. She must be able to meet people, be poised, well groomed, adaptable and cooperative.
4. She must have completed food preparation, food management and marketing, household equipment, and public speaking courses.
5. She will be given opportunity of working six months in home service department of the Minneapolis Gas Co. for basic pay. Three of these will be summer months and the other three can be either in fall or winter. To obtain the scholarship, the student must take the work experience.
6. Scholarship is to be awarded in the spring preferably, or fall. It is to be paid $250 ten days before the beginning of each of the two quarters when the winner is not working at the company.
7. Applicant must be of good character—honest and moral.

* * *

The Why of Home Calls—Mary E. Huck, The Ohio Fuel Gas Co., Columbus.

Why are home calls so often referred to as the "backbone" of home service? They are, without a doubt, the major part of every home service program. Since they are a day after day, month after month activity, home calls are generally accepted without question and are seldom scrutinized objectively. Are we making home calls just because it's always been done? Are they a necessary evil or an essential part of your gas company's operation? Are the benefits derived enough to warrant the time spent? Why home calls?

This can be answered best, perhaps, by evaluating home calls in terms of benefits—

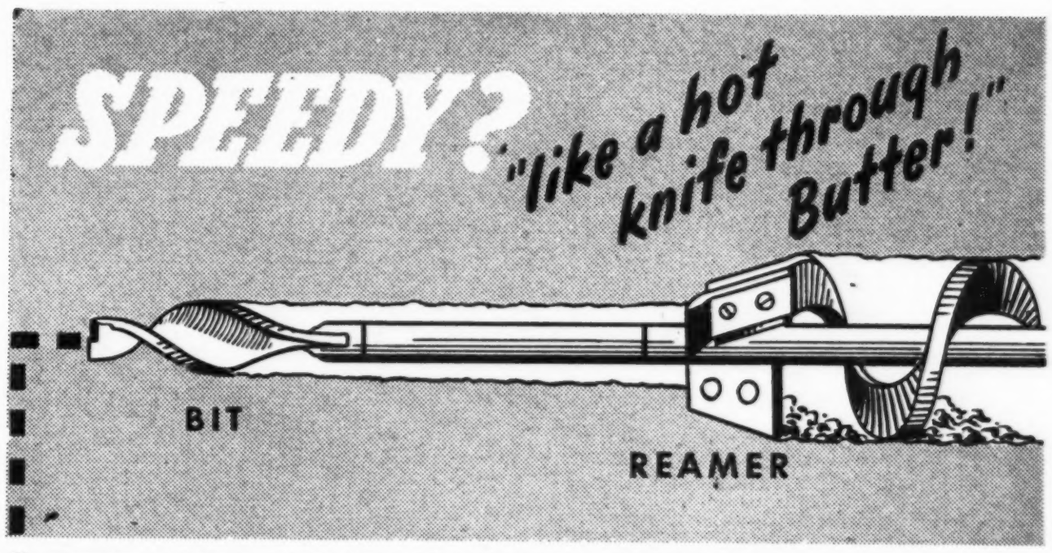
*W*hat benefits does your customer receive from the home call?

*H*ow can your gas company benefit from an effective home call program?

*Y*ou, as a home service person, receive what benefits?

In a typical range follow-up call, one of the major benefits to the customer is the increased use of a modern gas range. In all probability the new range is replacing one of about 1929, or even earlier vintage. Unless the customer is shown the many conveniences of present-day gas equipment, she cannot take full advantage of her new range. Through a home call, she learns many uses of the simmer burner; she sees unending time-saving possibilities of the automatic clock; she understands how to get the most from her appliance with the least effort.

In the same way your home service representative resells the range to the customer so that she is satisfied with her investment. . . By complimenting the customer on her choice of a modern gas range and going over its features and conveniences, your home service



THE LOW COST WAY TO INSTALL ANY PIPE

Even the toughest earth formations, like rotten rock, are no obstacle to Hydrauger operations. In fact, Hydrauger has fewer limitations, especially in time and costs, than trenching; and it is more certain than pipe-pushing, particularly if the pipe is coated, wrapped or of large size.

Write for Catalog No. 8 TODAY!

HYDRAUGER CORP., Ltd.
681 Market Street
San Francisco 5, California

OPEN HOLE

Hydrauger*

* Reg. U. S. Pat. Office

HY-13c

EARTH BORING TOOL

WHY WELSBACH PRODUCTS ESTABLISH A QUALITY STANDARD

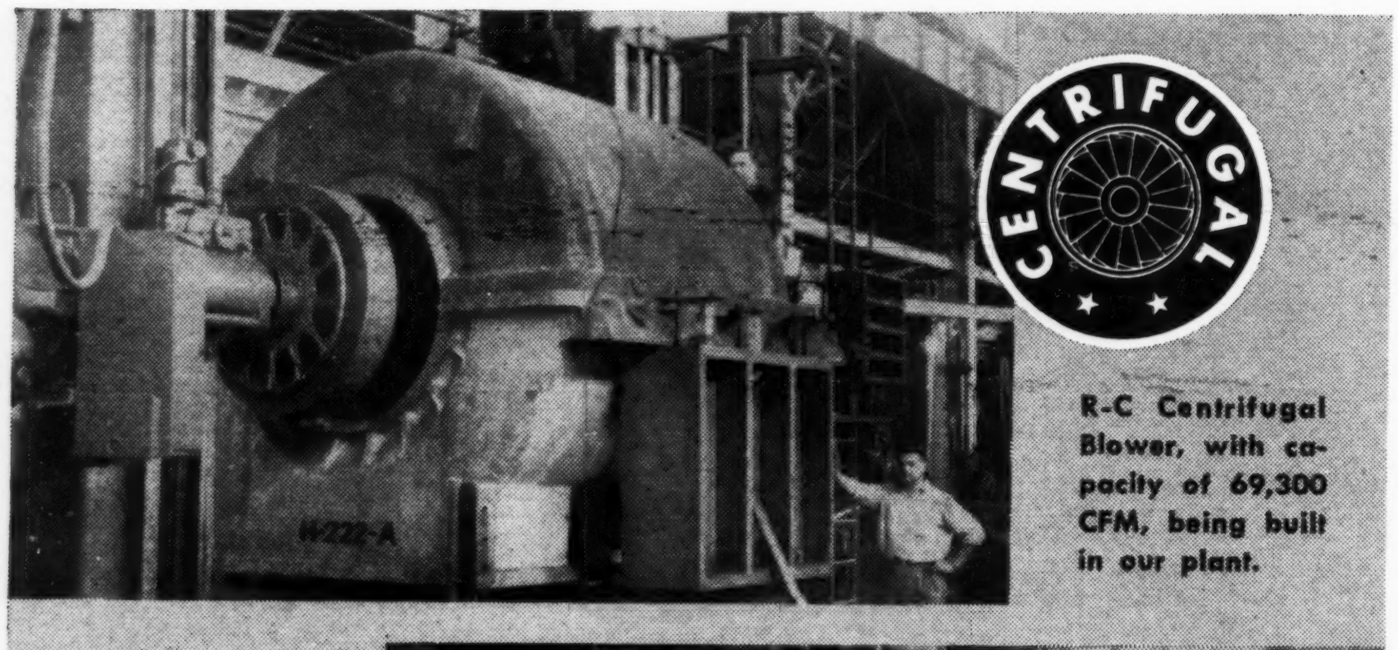
When several generations of utility engineers favor one company's products, you can be sure those products measure up to the highest standards. Welsbach on a valve, or a meter connection, indicates long-life, sound construction and intelligent design, for dependability and safety. Have you reviewed your Welsbach (Kitson Division) literature lately? Write today.

WELSBACH
Tamper-Proof
High Pressure
Gas Valve
1" Inlet
¾" Outlet
G-452

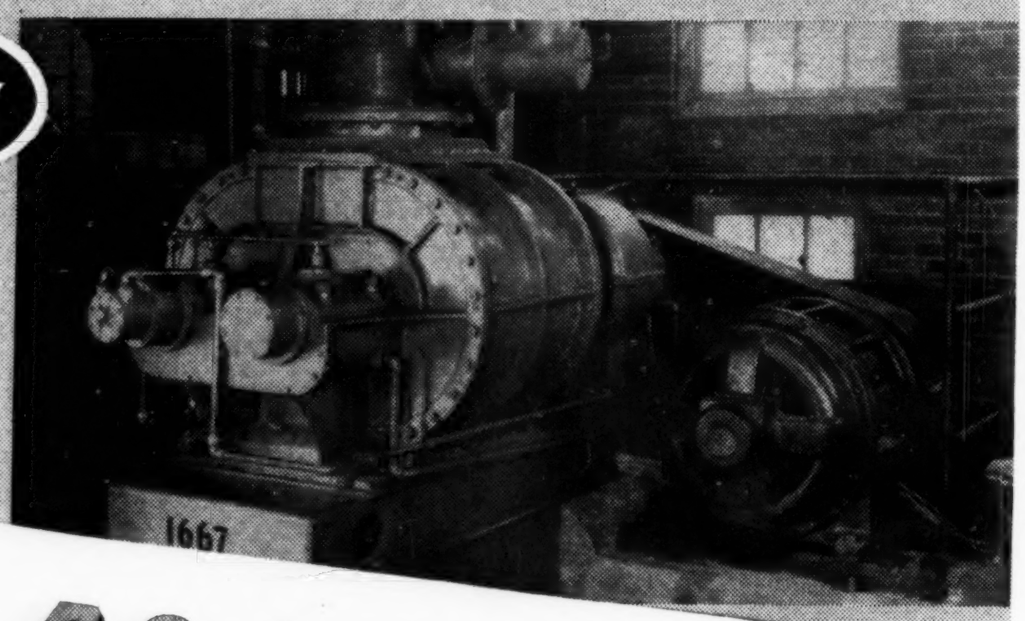
It's a brand new product.

THE WELSBACH CORPORATION
KITSON DIVISION
1500 Walnut Street Philadelphia 2, Pa.

WELSBACH METER CONNECTIONS
With cast iron bar and built-in lock wing gas stop. All Sizes



R-C Centrifugal Blower, with capacity of 69,300 CFM, being built in our plant.



R-C Rotary Blower, type RCD, capacity 6,200 CFM.

LET *R-C dual-ability* SETTLE THE QUESTION

If you are in doubt about whether Centrifugal or Rotary Positive units will do the best job of handling gas or air on any specific application, you can obtain an unbiased answer from R-C *dual-ability*.

Because we build both types, in wide ranges of sizes and designs, we can make sound comparisons and can recommend without prejudice the units whose capacities, pressures, drives and other characteristics deliver the best performance.

Only Roots-Connersville gives you this *dual choice*. It comes from 95 years of designing and building gas and air handling equipment, exclusively.

ROOTS-CONNERSVILLE BLOWER CORPORATION
904 Crescent Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE

BLOWER BUILDERS R-C SINCE 1854

BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

★ ★ ONE OF THE DRESSER INDUSTRIES ★ ★

girl reassures the customer that she has made a wise purchase.

From a good home call the customer learns how to take proper care of her new range. As a result, she will use it more advantageously and should have few service calls.

This leads to still another benefit to the customer, that of the economical use of gas. Correct use of the range will reduce the amount of gas consumed. Your home service adviser brings the customer new recipes and leaves with her up-to-date and modern cooking information. She opens up entirely new fields of cookery to the housewife. In all sales follow-up calls the customer gains nutrition information—perhaps it is through an explanation of the vitamin saver method of cooking vegetables; through suggestions for using the broiler; or perhaps through a discussion of low temperature roasting.

An eighth direct benefit to the customer is that she learns of other available home service aids. As the company's goodwill ambassador, your home service representative tells the customer of the services you offer—i.e., radio programs, demonstrations, recipe sheets, or program suggestions. The customer is made to feel that she has a closer contact with your gas company, whom she can call upon at any time. In addition to learning more about the home service department, the customer will also learn of other helpful services which your company offers. . .

One of the benefits which the company derives from a good sales follow-up call is the customer's satisfaction with her new gas appliance. The homemaker who understands her equipment and uses it to the fullest will be a satisfied customer. Now you have an ardent supporter of the gas company and a volunteer salesman of gas appliances. The company benefits, too, from the customer's being shown the superiority of gas over electricity. She now has verbal ammunition which she can use to advantage whenever her bridge partner announces her intention to buy an electric range.

SERVICE CALLS REDUCED

I mentioned before that the information given on the care of equipment will result in fewer service calls. This shows up on the debit side of the ledger as reduced service costs. In addition to the service calls which are eliminated there are those which are prevented. Each time a well trained home service representative tightens a screw or adjusts a pilot, another service call is prevented.

Home calls also build load for the company. Because the customer understands how to use her new range she will do more baking and broiling. The recipes given to her on the call are an inducement for more extensive cooking. Tested recipes mean good results—this in itself spurs the homemaker on to try your other suggestions.

Home calls serve as a check, too, on service and sales. If the care and use stories told by the salesmen and servicemen are not correlated, this will come to light and be corrected on the home call. If the salesmen are selling with inaccurate information of range performance, this, too, will be brought to your company's attention. This gives the company a chance to correct situations which, if allowed to grow, might lead to poor public relations.

One of the chief benefits to your company

is the good will created as a result of a valuable service pleasantly rendered. Customers have a deeper appreciation of your company because of the interest vou have shown in them through home calls.

Home calls promote better understanding of your company's problems. These are explained to the customer in person. With this personal approach you arouse her sympathy rather than her criticism. Companies which have experienced restricted heating or gas emergencies are fully aware that home calls were a valuable aid in securing the customer's understanding of these difficulties. . .

PROSPECTS LOCATED

Not to be disregarded is the fact that through home calls the company finds prospects for other sales.

In companies which do not merchandise, the home call serves as the go-between for the dealer and the gas company. It affords an opportunity for the company to become better acquainted with the dealer and his problems.

The home service adviser, herself, is the third person to benefit from home calls. Her gains are not as tangible as those which have been mentioned in connection with the customer or the company. But they are apparent and should not be overlooked. I think the greatest benefit of all which home service derives from the call is the opportunity to talk informally with the woman in her home. It is here that your complete home service program is established. You learn what the women want and need and can plan your program accordingly. They set the pace for cooking schools, recipe services, club talks, and demonstrations.

Each home service representative derives personal satisfaction from having been helpful in a certain situation. She gets practical experience which rounds out or complements straight theory. Through home calls the home service adviser's professional prestige in a community is enhanced.

* * *

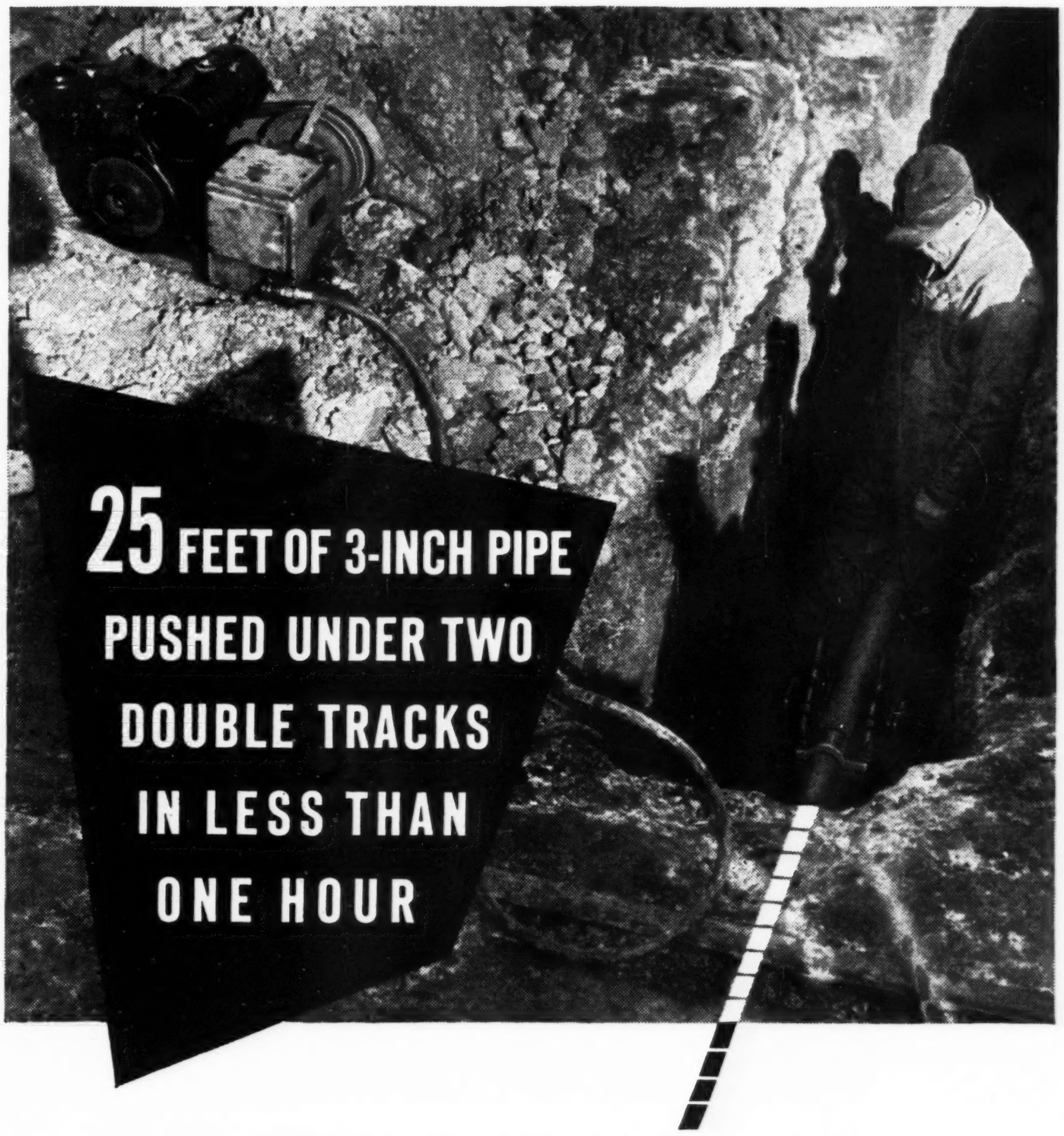
A Foods Demonstration, Circus Style—Nell Read, City Public Service Board, San Antonio.

Using four tools—color, music, lights and action—as the framework on which to build our programs, we adapted them to the circus theme and made them work for us. Invitations were individualized . . . Hand coloring on good stationery . . . assured us the invitation would be opened and read.

The auditorium, as well as the stage, took on a circus atmosphere, and the recipe sheets were decorated with clowns and balloons. Recorded circus music of the calliope greeted the guests and was played until the curtain was drawn . . . The home economists who were staging the demonstration went into action while a circus barker, backstage, blew a whistle and announced that things were ready to begin.

There really was a "three-ring circus" going on during the next 60 minutes as the home economist demonstrated the many cooking conveniences which a modern gas range can bring to a homemaker.

The careful employment of the four tools—color, music, lights and action—was the secret which made the promotion a success.



. . . with a GREENLEE HYDRAULIC PIPE PUSHER

"We made this fast, under-railway installation during a near-zero spell," reports Harris-McBurney Co. of Jackson, Michigan. "And without the GREENLEE Pusher and Power Pump we would not have otherwise even attempted the job.

"During the past three years we have used the GREENLEE Pusher to install many thousands of feet of pipe and telephone cable conduit under airport runways, streets, railways, and highways.

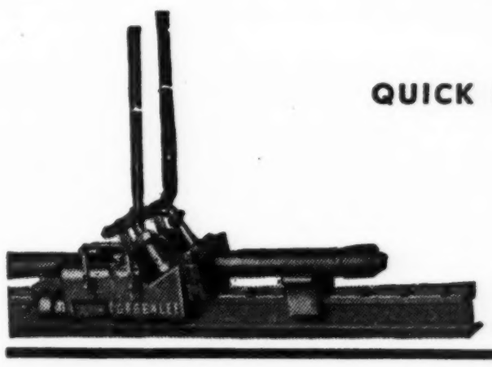
"By no means could these jobs have been done as efficiently, quickly, or at as low cost as with a GREENLEE. Ours paid for itself on the first job."

You, too, can make big time and labor savings with a GREENLEE which *pushes* pipe under obstructions. Eliminates extensive ditching since just a short trench accommodates the Pusher —no tearing up, backfilling, tamping, tunneling, repaving.

Get facts today on this timesaving, efficient tool. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1944 Columbia Avenue, Rockford, Illinois, U. S. A.

TOOLS FOR CRAFTSMEN

GREENLEE



QUICK FACTS ABOUT THE GREENLEE HYDRAULIC PIPE PUSHER

Easy — one or two men can easily operate on any job. *Portable* — compact, easy to carry to job and set up. *Fast* — operates at six different speeds. *Two models* — (1) for pipe up to 4-inch; (2) for larger pipe, drainage ducts, concrete sewer pipe. Do the job easier, quicker with a GREENLEE.

CATALOGS

PEERLESS PUMP DIVISION, Los Angeles, Calif.—Bulletin No. B-1300 describes the Peerless Type A centrifugal pump. It is complete with schematic sectional drawings, applications photographs, and sectional and dimensional drawings and tabulated material on all sizes of the line.

ROOTS-CONNERSVILLE BLOWER CORP., Connersville, Ind., has issued bulletin 22-23-B-13 on rotary positive blowers. The 20-page, two-color catalog opens with a foreword outlining some of the principal uses for the blowers. Separate pages are devoted to the four standard types now offered, showing complete views and cross-sections of each, with condensed specifications covering the four types. Other sections are devoted to a discussion of gears, types of accessories recommended and furnished, and applications.

STACEY DRESSER ENGINEERING, 1900 Superior Ave., Cleveland 14, Ohio—"Desulfo Plants" is the title of a new 8-page bulletin. According to this catalog, the desulfo plant will desulfurize sour gas at low cost, requiring no operating personnel or utilities, at negligible annual maintenance cost. A number of tables and drawings are included, and the material is classified under capacity, process description, and safety features.

WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J.—Bulletin L-640-B2 is a compressor selection chart for type HB single horizontal compressors. The chart, based on normal applications handling air with atmospheric intake pressure, simplifies selection of proper size compressor for average industrial use, with quick comparison between discharge pressure psi and piston displacement cu ft/min, and shows recommended compressor bore and stroke in inches. Copies of the chart may be obtained upon written request on company letterhead.

ECLIPSE FUEL ENGINEERING CO., 730 S. Main St., Rockford, Ill.—Three new catalogs have been issued by this company. "Eclipse 'Gas Pak'—A Complete Gas Combustion Assembly" is designated No. H-25 and describes the package unit for firing steam boilers, heating plants, industrial ovens, and other heating equipment. Bulletins L-500 and L-502 are devoted, respectively, to McKee cone-type diluters for automatic gas-air premix systems and McKee cone-type diluters for LP-Gas standby.

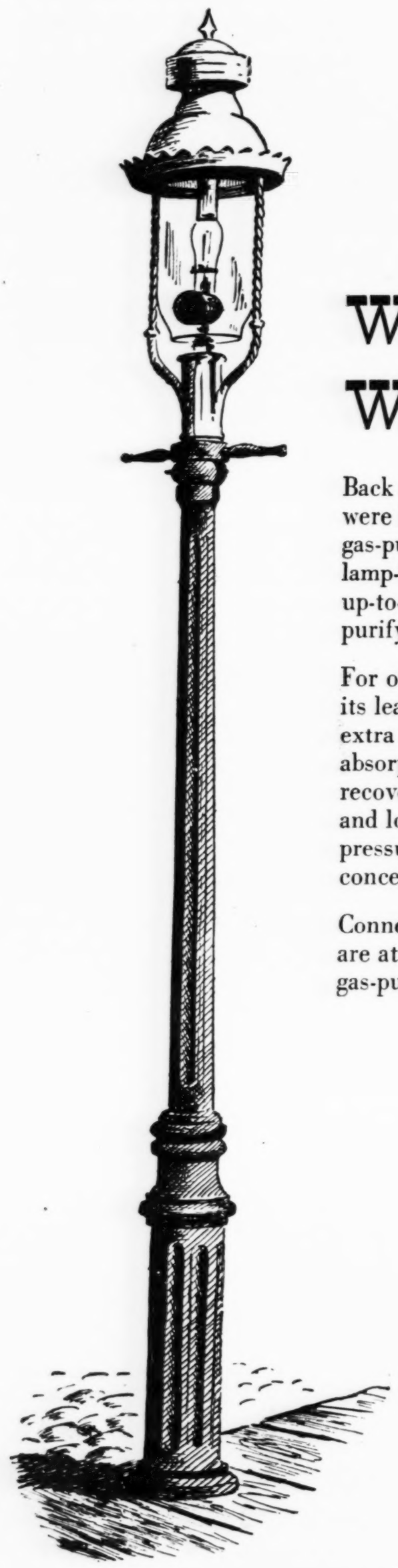
DRESSER MANUFACTURING DIVISION, Bradford, Pa.—A new 4-page folder describes Dresser "Bell-Pack" sleeve style 126. This sleeve is designed for the repair of broken cast iron bells and for the enclosure of leaking mechanical joints. Features are reduced weight, complete factory assembly, and increased effective inside clearance. A table lists sizes, specifications and list prices for style 126.

BLACK, SIVALLS & BRYSON INC., 720 Delaware, Kansas City, Mo.—Part 1, Section 6 of Catalog 54 describes Safwalk walkways and loading racks. Tubular heaters are discussed in Part 5, Section 3 of Catalog 54. Both sections contain a large number of photographs, sketches, and tables and are arranged under headings such as types available, construction, applications, specifications, etc.

GLOBE STEEL TUBES CO., Milwaukee, Wis.—This company has issued an attractive catalog on welded fittings. Twelve catalog sheets have been inserted in a loose-leaf three-ring folder. Complete tables of dimensions are given for the various types of welding fittings. Copies of this catalog, No. 501, will be mailed without cost to engineers, executives and technical men.

OWENS-CORNING FIBERGLAS CORP., Toledo 1, Ohio.—"Underground Pipe Wrap" is the title of an 8-page catalog describing Fiberglas, a thin, porous mat of long glass fibers which serve as a carrying and reinforcing agent for coatings or impregnants, adding high tensile and impact strength. Included are a packaging data chart and mileage table.

LEEDS & NORTHRUP CO., 4907 Stenton Ave., Philadelphia, Pa.—"Speedomax Type G Instruments for Measurement and Control" is the title of catalog ND46(1) which includes the entire line of Speedomax instruments listed in one book for the first time. The publication describes these instruments for all the uses for which they are now available.



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SURFACE COMBUSTION CORP., Toledo, Ohio—An 8-page folder titled "Surface Industrial Furnaces" and designated SC-141, was issued recently. Equipment for a broad range of processes is presented, and the folder provides a survey of what is available in standard equipment, designs completed, and parts in stock.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, Minn. — This company has issued a heating controls trade price list, effective Dec. 31, 1948. The prices supersede those in the 1948 condensed catalog and separate price list.

CROWN STOVE WORKS, 4631 W. 12th Place, Chicago, Ill.—A colorful, well illustrated catalog describes the Crown line of gas ranges. Special emphasis is placed on the Harper Center Simmer burners which are featured on Crown ranges.

CURRENT READING

FISCHER-TROPSCH PROCESS—Variable operating factors affecting the yield of synthetic liquid fuel products from the Fischer-Tropsch process are discussed in a new Bureau of Mines report of investigations released recently by James Boyd, bureau director. Research on gas synthesis is being conducted as a part of the bureau's extensive program investigating methods for producing synthetic fuels from coal, oil shale, and other materials.

Four of the principal variable factors in the Fischer-Tropsch process are contact time, temperature, pressure, and gas composition. In producing synthetic gasoline, the bureau report points out, high operating temperatures are desirable to increase the yield.

A discussion of cobalt carbides as intermediates in the synthesis is included in the report along with graphs illustrating the effect of variables in the process. The report was prepared by Sol Weller, physical chemist of the Coal Hydrogenation Section, Research and Development Branch, Central Experiment Station, Pittsburgh, Pa.

Free copies of the publication, Report of Investigations 4405, "Effect of Operating Variables Upon the Fischer-Tropsch Synthesis," may be obtained by writing to the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

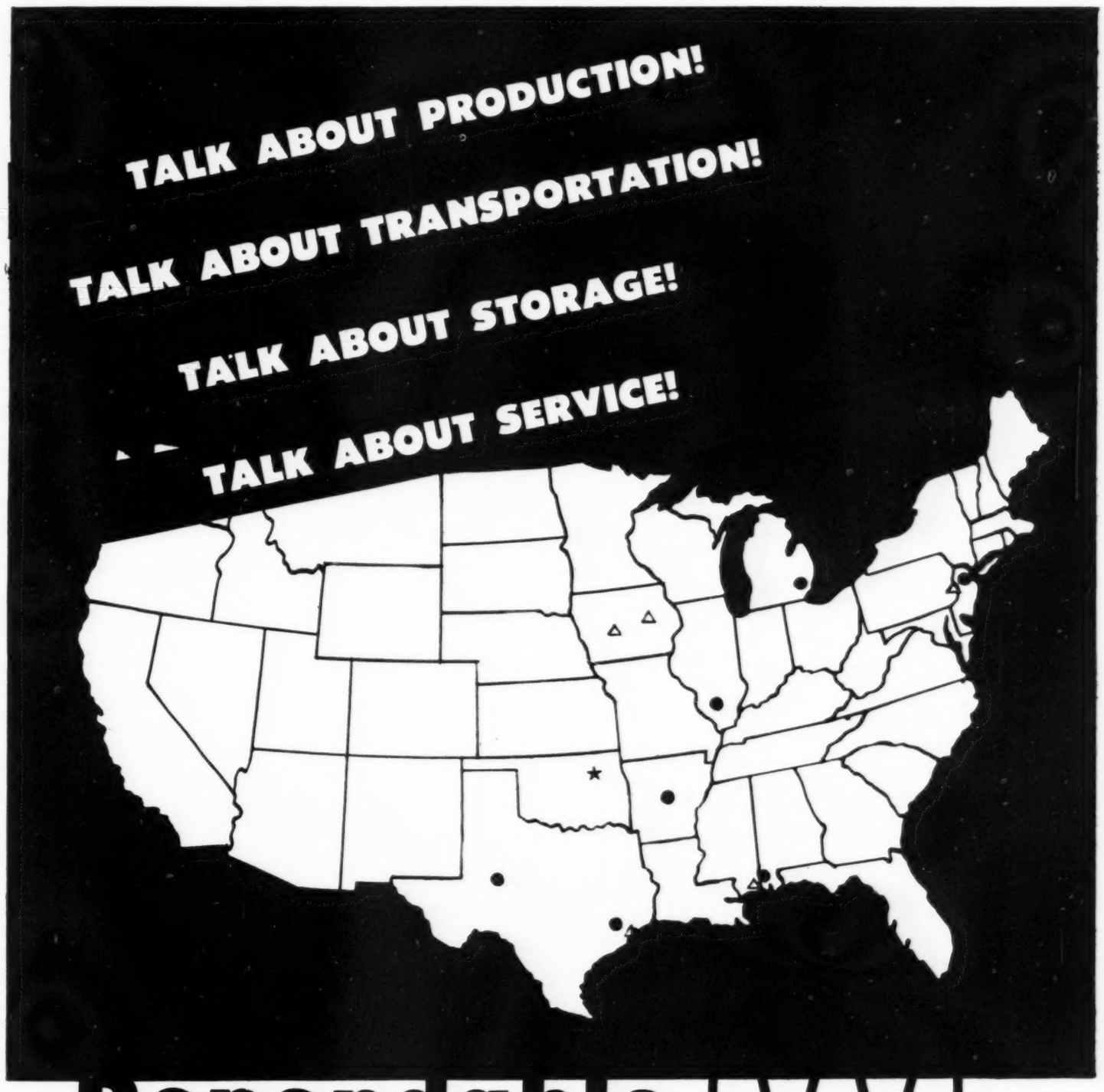
SELLING GAS APPLIANCES is a 191-page book which was prepared by the Sales Section of the Southern Gas Assn., 1230 Mercantile Bank Bldg., Dallas. Price: $2. The book is divided into nine units, covering the following topics: Basic information for the appliance salesman, fundamental sales principles, how to develop your sales potential, development and use of a prospect file, how to make an effective sales presentation, selling modern gas cooking, selling modern automatic gas water heating, selling the modern Servel gas refrigerator, and selling modern gas house-heating.

OIL—FACTS VS. FALLACIES is a book recently released by the Independent Petroleum Assn. of America, Tulsa, Okla. Numerous graphs are used to emphasize facts about production, reserves, drilling activity, exports and imports, prices, etc. The general viewpoint of the book is expressed on the inside front cover: "This nation need never be short of petroleum products in the foreseeable future. The road to well-being, security and expanding strength as to oil and gas lies in a strong, competitive domestic industry."

FIFTH SEMIANNUAL REPORT of the Atomic Energy Commission, January 1949, U. S. Government Printing Office. The following paragraphs are excerpts from the foreword.

Atomic energy development in the United States is now 10 years old. It was in the last week of January 1939 that the phenomenon of nuclear fission was first confirmed in the United States. In one decade, a whole new body of knowledge has been built up. Frontiers of science have been pushed ahead. Atomic energy has been used as a weapon of war, but it also holds promise of great benefits to mankind. Men are diligently seeking the means of developing the new knowledge and of controlling this force in order to realize those benefits.

Two years ago, the U. S. Atomic Energy Commission was established under the Atomic Energy Act of 1946, which sets forth the broad policies and objectives of the national atomic energy program. During these two years the troublespots which threatened continuity of production of fissionable materials have been largely eliminated. The weapons situation has been greatly improved. Impor-



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tant additions have been made to scientific and technical knowledge. A program for the development of nuclear reactors aimed at the possible production of power and the breeding of new fissionable materials has been formulated and is being vigorously prosecuted.

A reorganization of the commission's principal office to meet operating requirements is nearly complete, and the addition of new key personnel has materially strengthened the commission's staff. The office of the director of intelligence has been established to correlate and evaluate information on foreign atomic energy developments. This office maintains close collaboration with other intelligence agencies of the government.

This fifth semiannual report of the commission to the Congress, recording an expansion of effort in all phases of atomic energy development, is prepared against a background of world affairs which makes it necessary for the American people to maintain self-imposed restraints on the dissemination of a vast amount of data acquired since the beginning of the atomic energy enterprise in 1939.

Since that time, the American people have invested more than $3 billion in atomic energy, starting with the first allocation of $6000 in 1940 and including $342 million expended by the commission in 1947 and $525 million in 1948.

This report, and a subsequent special report on Reactor Development which the commission will submit to the Congress in the near future, are attempts to provide information on plants and on operations essential for an understanding of the purposes and results of the nation's heavy expenditures for atomic energy development, and the problems and difficulties encountered in the program.

The report indicates expansion and improvement all along the atomic energy development chain from the mines to the ultimate use made of fissionable material. Activity has stepped up steadily in 1948. The first year of the commission's stewardship of the atomic energy project, 1947, was largely spent in analysis and planning, with a start made on needed expansion. In 1948 the full program of long-range development got under way. Actual production operations were improved and output increased. The fact is, however, that the important research and development problems in atomic energy have yet to be solved.

DEVELOPMENT AND TRENDS in the Design of Flanged Joints by E. G. Schmidt, supervising engineer for the Crane Co., Chicago, recently was printed in the company's publication, "Valve World." The paper originally was presented to the 1948 National Conference on Industrial Hydraulics. Copies are available in bound form from S. F. Musselman, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill. A portion of the introduction follows:

"The purpose of this paper is to present briefly a picture of the development of flanged joints, the factors influencing their development, and work which has been done recently to create joints which are simple, positive in action, and easier to use. Pressures to 1500 psig and temperatures to 1000°F are covered."

MARKET RESEARCH SOURCES, 1949, is to be published soon by the Department of Commerce. The book is designed to provide an up-to-date statement of the marketing research activities of public and private agencies. Revised and issued biannually from 1926 to 1940, it was suspended during the war. In resuming publication, the Department of Commerce "is giving recognition to the current demand from manufacturers, distributors and sales and marketing executives for information useful in analyzing markets, establishing market potentials, setting sales quotas and laying out advertising campaigns." Material for the book is being solicited through questionnaires.

PRINCIPLES AND PRACTICE of Flow Meter Engineering has been issued in its sixth edition by The Foxboro Co., Foxboro, Mass. The author is L. K. Spink. Accuracy of the center-line velocity and pipe-factor method of applying the pitot tube is described in the handbook. Pipe factors plotted correspond closely to values given for 16-in. commercial iron pipe approximately 10 years old or for newer pipe in smaller sizes. Price: $3.

THE APPLICATION of Gas to Counter Appliances is the subject of Research Report No. 1112 of the AGA Testing Laboratories. The project, No. IGR-54, was sponsored by the Committee on Industrial and Commercial Gas Research. The following abstract summarizes the report. Copies of the complete bulletin may be obtained from the AGA at 75 cents each.

A resume of the contemporary method of applying gas heat to steam tables with respect to design, performance characteristics, and control equipment is presented together

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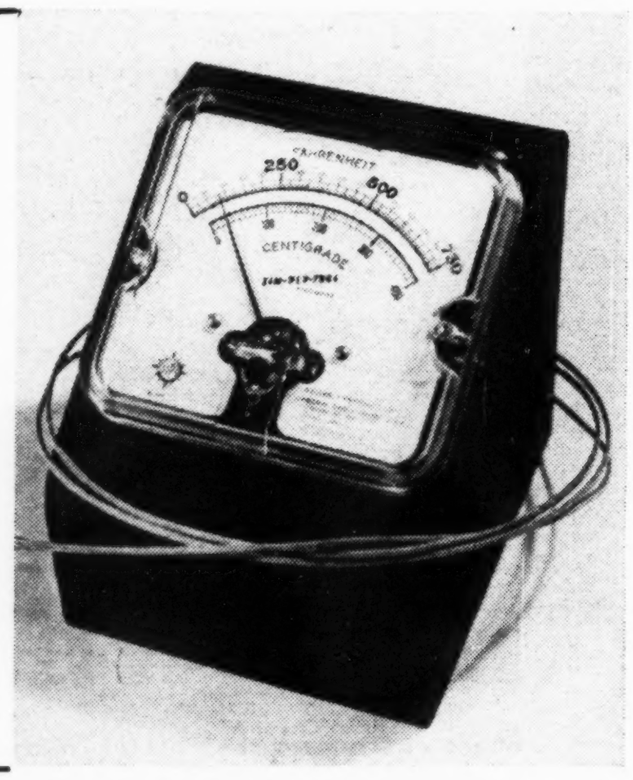

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with practical suggestions and design information toward solving the problems encountered in heat application, aeration, venting and control of such equipment. It is shown that through proper design, correct burner application, and employment of control equipment, performance and appearance of steam table equipment may be greatly improved.

While this report has dealt almost entirely with design of under-fired gas steam tables, it should be pointed out that the flexibility of application of gas as a fuel permits many designs including indirect fired steam tables where required by air conditioning load or other conditions of operation. Indirect heating of the water bath by hot water or steam coils supplied by gas-fired water heaters has been employed to advantage in such installations. Indirect firing by immersion tubes has also been employed in a few instances.

Gas heated dry food warmers maintain food at serving temperatures as do steam tables, and are directly heated by flue products without use of an intermediate water bath. This type of unit is frequently built to maintain different temperatures for different foods stored in the same food warmer, while in steam tables foods are often held at the same temperature. Use of gas dry food warmers is expanding rapidly. Since design, construction and operation of dry food warmers differ appreciably from steam tables, factors affecting the application of gas to such warmers will be discussed fully in a subsequent research report of this series.

THE AGA TESTING Laboratories have released two Domestic Gas Research bulletins.

No. 49 is titled *"Study of Accumulation of Combustible Deposits in Kitchen Ventilating Systems."* This bulletin presents evaluations of the extent to which grease, dust and lint deposits occur in and around the cabinet type and "Rochester" type ventilating systems. Applicability of local building codes and ordinances to kitchen ventilation installations is discussed on the basis of laboratory performance tests and field experience.

Data are also presented indicating the effectiveness of the cabinet type and "Rochester" type ventilating systems in removing surplus heat and moisture from kitchens at various air withdrawal rates. Descriptions of other contemporary systems are appended to this report.

The conclusions and recommendations are as follows:

"Grease, dust and lint depositing in and around domestic kitchen ventilating systems tend to be most concentrated at the air intakes and in the first few feet of ductwork. Accumulation of soilage may be found in decreasing amounts of duct sections leading from the range to the blower. Apparently such deposits of grease, dust and lint do not create a fire hazard, even when subjected to temperatures higher than those normally encountered in range operation.

"In domestic kitchens equipped with mechanical ventilating systems, wall cabinets located directly above the range seem to become more heavily soiled than cabinets placed on either side of the range. While a somewhat similar trend may be observed in a kitchen not equipped with mechanical means for ventilation, grease and dust appear to deposit more uniformly throughout the kitchen than in a mechanically ventilated kitchen. Location of heaviest soilage in various parts of a ventilated or non-ventilated kitchen is apparently dependent to some extent on the type of wall surface employed.

"There appears to be a need for inclusion in present building codes of regulations which would be specifically applicable to the installation of domestic kitchen ventilating systems. Ordinances which are now interpreted as governing such installations in some cities may not be adequate, while in other localities there is an apparent lack of applicable specifications.

"From overall considerations it appears that an air withdrawal rate of 300 cfm may generally be suggested as an effective rate for removing from the kitchen surplus heat and essentially all moisture resulting from cooking operations. This conclusion is predicated on the assumption that an adequate air supply would be provided to the house so that interference with the operation of other fuel burning equipment would not be encountered. While air withdrawal rates greater than 300 cfm may serve to remove more heat, they may not be desirable depending upon design of the residence and the individual customer's opinion regarding comfort conditions. This conclusion substantiates those previously reported in Bulletin No. 40."

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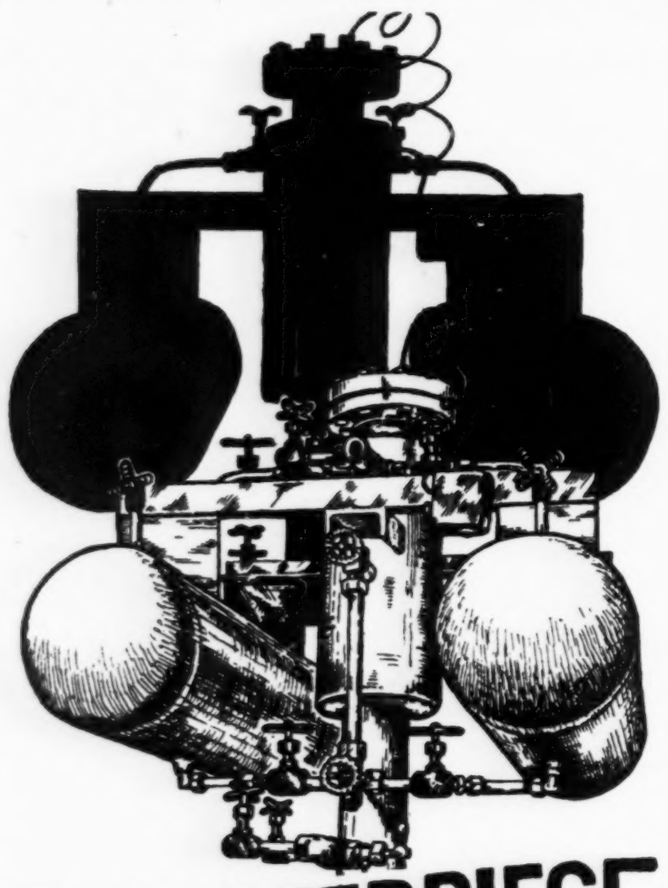

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Bulletin No. 50 is called *"Research in Range Top Burner Ignition at Reduced Gas Input Rates."*

This bulletin presents results of studies made with various designs of main burner lighter ports, gas valves and flash tubes in investigating the performance characteristics of automatic ignition or reignition of top burners at low gas input rates.

A method is described whereby reliable automatic ignition of top burners on natural and manufactured gas is attained at rates as low as 15%-17% of full burner rate. This is accomplished with a change in flash tube design when gas is supplied to all burner ports.

Data are presented indicating that by specially designing the main burner lighter port, gas valve and flash tube, automatic ignition may be effected at as low as 11%-15% of full input rating.

The conclusions state that "from results of this investigation it appears that ignition (or reignition) of single and dual type top burners is not completely effective on contemporary range designs on either natural or manufactured gas, when these top burners are operated at input rates of less than about 46% of full rating (9000 Btu per hr) with gas supplied to all burner ports.

"It appears that automatic ignition can be effected at as low as 17% of a full rate of 9000 Btu per hour with natural gas and 15.5% of full rate with manufactured gas, provided the flash tube is designed with this objective in mind, when gas is supplied to all burner ports. Such features as oval ends of the flash tube at the lighter port end, a slight inclination of the flash tube toward the pilot, and a stack effect above the pilot burner seem to be significant in designing a flash tube system for obtaining ignition at a low top burner input rate.

"It also appears possible to obtain automatic top burner ignition at input rates as low as 11% of full rate with manufactured gas and 15% of full rate with natural gas if the main burner gas valve, main burner lighter port, and flash tube are specially designed for this purpose as in this investigation. Rates of this magnitude approximate the minimum practical adjustment in service attained with most contemporary range top burners. Effectiveness of this latter system depends, however, on a separate gas supply line from a modified dual burner valve to the main burner lighter port to provide for full lighter port rating at all times when the main burner is in operation."

DAV Contest

The Disabled American Veterans Service Foundation is sponsoring a national contest, giving $100,000 in prizes, as its major fund-raising effort this year.

The foundation is incorporated trustee for the DAV.

Proceeds from the contest will go to the foundation to help support its service activities. Details of the contest, which is of the word-building variety, may be obtained from Disabled American Veterans, Box 100, New York City.

SALES SLANTS

THE GAS INDUSTRY'S cooperative national advertising for the balance of 1949 will continue to push the automatic range and will spend an additional $1 million on the court of Flame water heater plan. AGA will devote $110,000 of its 1949 advertising budget to national water heater ads, starting with a four-color, two-page spread in *The Saturday Evening Post* on May 7. Twenty-three leading water heater manufacturers will spend a minimum of $450,000 in national consumer magazine advertising, and local gas utilities, distributors, dealers, and LP-Gas companies will bring total expenditures up to the $1 million mark. Goal of the Court of Flame campaign, sponsored by GAMA, is the sale of 2 million gas water heaters. (See *GAS*, Feb., p. 77.)

SERVEL INC., in cooperation with distributors, dealers, and gas utilities, is sponsoring a weekly quiz show called "What's My Name." It is aired over the ABC network on Saturday mornings. One of the rules requires that contestants secure entry blanks from their local Servel dealer, thus promoting dealer traffic. Prize for correctly identifying a "mystery voice" is a W-800 Servel. Other prizes, including a gas range and water heater, are added to the jackpot when the voice is not correctly identified. According to R. J. Canniff, advertising and sales promotion manager, "The show is expected to increase sales at the retail level by drawing more prospective customers into dealers' stores."

AMERICAN METER CO. and subsidiaries held their annual sales meeting in the Stevens hotel, Chicago, Feb. 1-3. The advantages of American Meter Co. products, recent developments, the results of project and research programs, as well as effective engineering and customer service assistance, were analyzed and discussed. In attendance were 35 men from American Meter Co., 11 from Westcott & Greis Inc., two from Reliance Regulator Division, and two from Canadian Meter Co. Ltd.

A NEW DISTRICT sales office has been opened at Madison, Wis., by the LP-Gas division of Warren Petroleum Corp., Tulsa, to facilitate handling of the company's increased business in the North Central states. J. T. Bradley, formerly of the Tulsa headquarters staff, has been promoted to district sales manager and placed in charge of the new office in the Tenney Bldg. J. W. SCHRIEVER JR. also has been transferred from Tulsa to Madison as district sales representative.

A PAPER TAG showing the AGA Laboratories approval seal has been designed for attachment to approved appliances for sales or display purposes. It does not replace the approval seal in permanent form which is required as part of the official marking of every approved model. The tags are available at $3.50 per thousand f.o.b. Cleveland.

GEO. D. ROPER CORP.'S Pacific Coast Dicision inaugurated its own television show on March 6. The program, on KFI-TV (Channel 9), reaches approximately 360,000 listeners. Billed as "Spotlights, with Barbara de Costa," the show features songs by Miss de Costa and Roper promotion.